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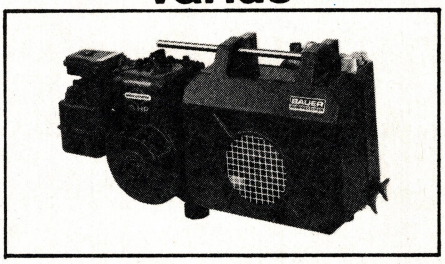
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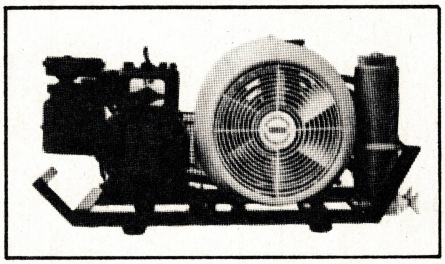
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skin diver
Volume Thirty Number Five

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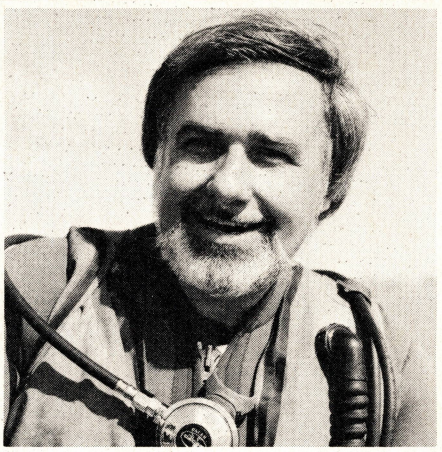


COVER
Diver Donna Schnabel trains a friendly spotted moray to sit up for its dinner at snapshot reef, San Salvador, Bahamas. Geri Murphy took the photo with a Nikonos III/15mm lens and Oceanic 2001 strobe.

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SDM Editorial

BY THE PUBLISHER



CLEAN UP YOUR ACT WITH A REGULATOR RETUNE

A dive regulator is subjected to a wide variety of corrosive contaminants because of the harsh environment in which it must function. Salt air and saltwater moisture from ocean trips can collect inside and freeze working parts. Carbon dust, chlorinated water, ozone and hard-water mineral deposits can also do damage. The accumulation of these harmful deposits is usually not noticeable because the process is so slow, so gradual.

Even though you have stored it in a cool, dry place, those deadly corrosive contaminants have had their chance to form hard, crusty deposits in the regulator and do more harm than actual use in open water. Much of this damage goes unnoticed because it is happening inside, hidden from the eyes of the owner.

Interviews with several leading regulator repair technicians have revealed seven deadly sins against regulator performance:

1) HARD BREATHING is most commonly caused by saltwater corrosion. Internal moving parts become encrusted with salt crystals and a crusty scale, which causes them to stick or operate sluggishly. Inhalation resistance is often tripled or quadrupled, thus making it extremely difficult or impossible to obtain sufficient airflow at depth during heavy breathing.

2) RUST CLOGGING the sintered filter of the first stage can be caused by the rust or corrosion dust which accumulates inside a scuba tank. Fine rust particles clog the pores of the filter screen and often coat the internal moving parts, causing sluggish or sticky operation. Rust clogging is a more common occurrence with rental tanks.

3) CARBON DUST CLOGGING sometimes results from ultra-fine carbon dust, the by-product of a poorly-operating air compressor. The carbon dust comes from the charcoal filter on the air compressor. This condition may go unnoticed for quite some time because the buildup is so slow and the dust almost invisible.

4) WATER LEAKAGE in the regulator mouthpiece is commonly caused by the deterioration of the second stage exhalation valve. The super-thin rubber disc becomes gummed-up from the effects of chlorinated pool water, ozone in the atmosphere, or normal aging. Stickiness of operation can cause increased exhalation resistance, intermittent water leakage and finally, complete flooding of the second stage.

5) FREE FLOWING can be caused by dirt or dust particles which mar or dent the high pressure valve seat in the first stage. The smallest speck of dirt or rust on this finely-machined surface can cause a steady seepage of high pressure air into the low pressure hose and second stage. The damage is irreversible and the leak tends to get worse with additional use, until air is flowing out of the regulator mouthpiece in a steady, uncontrolled stream.

6) O-RING LEAKS can result from the buildup of salt corrosion inside the regulator or from a general drying out of the silicone lubricant needed to keep these seals healthy. The slightest crack, tear, nick or split on the surface of an O-ring will break the seal and cause either an intermittent or steady leak of air. Continued use of a faulty O-ring can result in a complete break of that seal and the rapid flow of large amounts of air.

7) ERRATIC FLOW of air can be caused by a second stage which is not properly tuned or has parts that are sticking. The intermediate stage pressure may be wrong, or the second stage lever improperly set, or perhaps the breathing diaphragm is dried out and brittle. Internal parts and settings go out of whack as a result of aging, hard use, or saltwater exposure.

No amount of washing or careful use can completely prevent your regulator from getting out of tune. Routine maintenance can prolong its good performance, but eventually your regulator will need service and retuning. The job should be done every six months or once a year, depending on the amount of usage and the kind of exposure your particular unit receives. Generally speaking, a good internal cleaning (ultrasonic or acid dip) by an experienced regulator repair technician will take care of 90 percent of the performance problems. Parts replacement is generally minimal, amounting to a few O-rings, and perhaps a valve seat and more flexible breathing diaphragm.

Considering the vital importance of good regulator function, the cost of cleaning and retuning is surprisingly reasonable. Prices range from $15 to $35, most of which is for technician labor. When you divide this repair charge by the number of months of trouble-free performance you receive, it amounts to a small maintenance charge of two to three dollars per month. It is a small price to pay for the care of a life support device.

Where should you take your regulator for repair? You have several options available. The most obvious is your local professional dive store where you may have originally purchased your regulator or where you regularly obtain air fills. Many pro dive stores maintain a well-stocked service center for the equipment they sell, and their repair technicians are sent to dealer repair workshops conducted by the factory. Another option is to send your regulator to one of the large regulator service centers that specialize in the repair of regulators, hydrostatic testing of tanks, and servicing of other scuba accessories. Your regulator can be mailed in, serviced and returned in less than two weeks. Still a third option is to send your regulator back to the factory where it can be overhauled by personnel who generally have every conceivable replacement part at their disposal.

The most important thing to remember about getting your regulator repaired, cleaned, or retuned is that it should be done *early*. Don't go in the water if your regulator isn't performing the way it did the day you bought it.

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Diver's Calendar

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May 3 8th Annual Underwater Easter Egg Hunt, Chillicothe Sportsman Club. Sponsored by the Orca Dive Club. (Contact Gary E. Wilson, President, Orca Dive Club, P.O. Box 1587, Peoria, Illinois 61655)

May 8-9 New York State Marine Science Education Association's Annual Conference. Hofstra University, Hempstead, NY. (Contact: Steven Lander, Conference Chairman, at East Rockaway H.S. (516) 887-3111; or Prof. Eugene Kaplan, Hofstra Univ., (516) 560-3261)

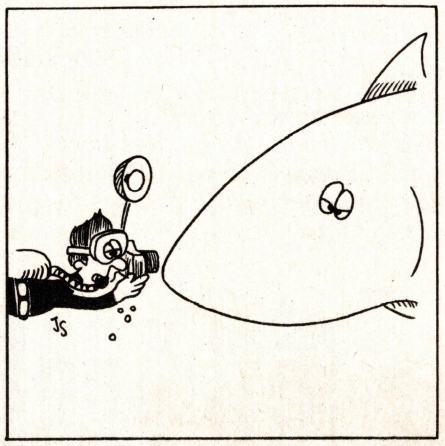
May 8-10 Our World Underwater, Radisson-Chicago Hotel/Civic Opera House. (Contact: Our World Underwater, Box 4428, Chicago, IL 60680)

May 9 Virginia Sport Diving Workshop, Yorktown Victory Center, Yorktown, Virginia. (Contact: Jon Lucy, Sea Grant Marine Advisory Services, Virginia Institute of Marine Science, Gloucester Point, VA 23062)

May 18-June 24 U/W Archaeology and Maritime History Course. Offered by the Field School Staff of East Carolina University. (Contact: Dr. William N. Still, Jr., Naval Historian, Dept. of History, East Carolina Univ., Greenville, NC 27834)

May 23-24 National Speleological Society's 17th Cave Diving Safety Workshop, Branford, Florida. Everyone is invited. (Contact: Henry Nicholson, 4517 Park St., Jacksonville, FL 32205)

June 27 Sixth Annual All Women Scuba Dive, Rockport, Mass. (Contact: Valerie J. Costelloe, Aquawomen, P.O. Box 775, Central Square, Cambridge, MA 02139)



"O.K. . . . back up just a little!"

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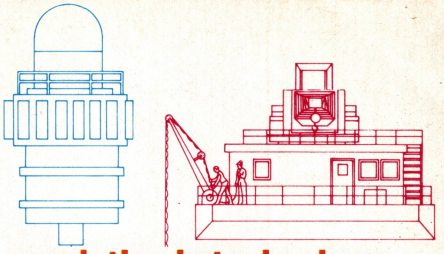
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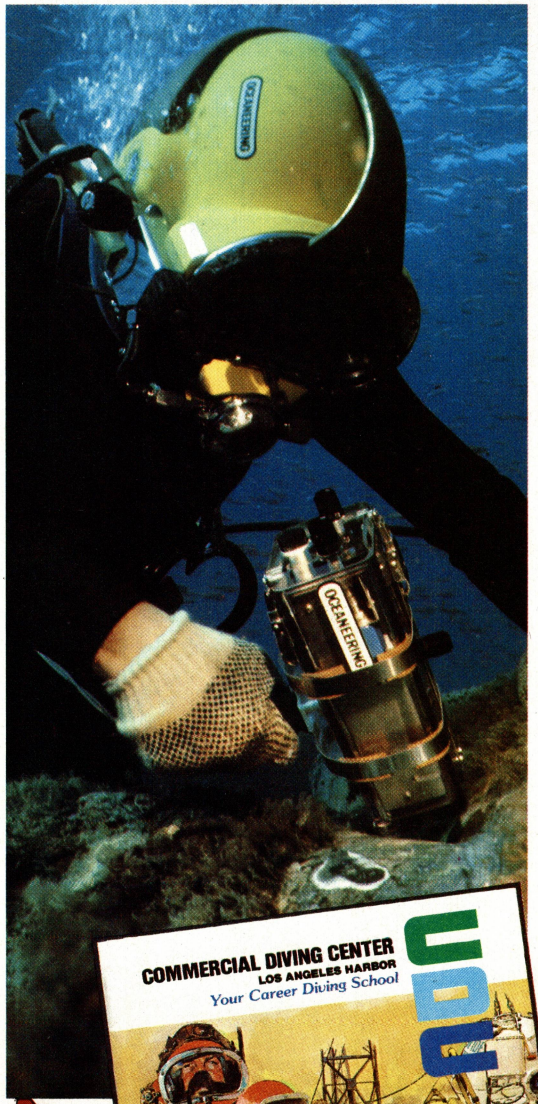
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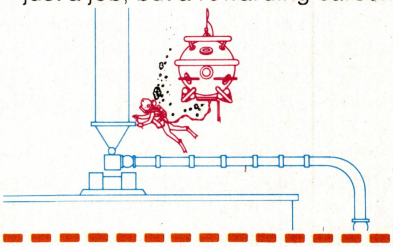
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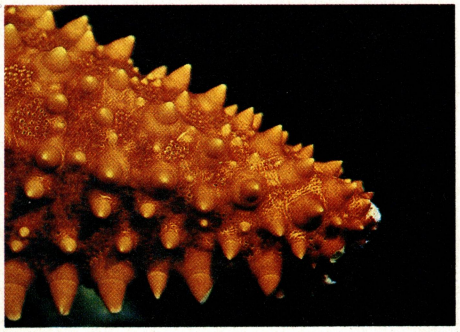
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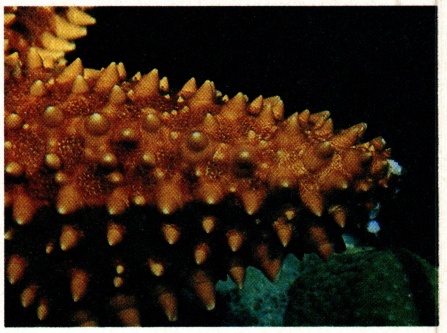
Open Water Comparison of 5 Kodak Films



1:2 Macro with flash K25 at f11



K64 at f16



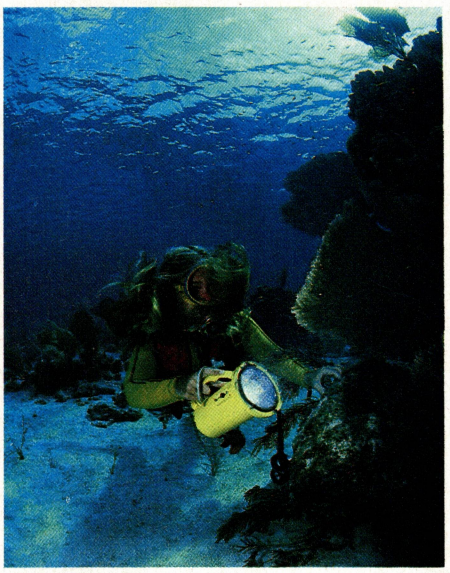
E64 at f16

Underwater photography is a vast and complex field. Besides all the scuba gear they must wear, divers must also concern themselves with cameras, housings, flash, uncooperative subjects and correct exposures. But of all the items necessary for underwater photography, film is the most important and often is not given much consideration. Many underwater photographers base their decision on recommendations of other photographers or trial and error. Some buy whatever film is available in their local camera store.

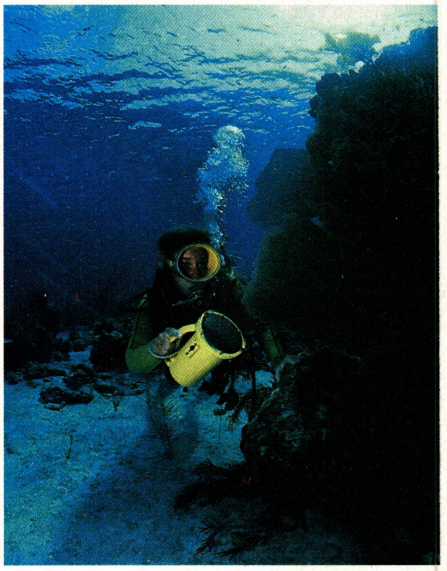
Because underwater photographers lack the proper information, a special film comparison was conducted to help them make that critical film choice. Most underwater photographers tend to use Kodak slide film, so our comparison centered on five Kodak films and how they differed when used underwater — Kodachrome 25 (K25), Kodachrome 64 (K64), Ektachrome 64 (E64), Ektachrome 200 (E200), and Ektachrome 400 (E400).

Several measures were taken to ensure accuracy. The color chart and gray card were not used as they were considered invalid for this comparison. They are basically used on land for testing film type versus light source. For example, daylight film is tested with this color chart in daylight and tungsten film is tested under tungsten lights. The light underwater differs from 100 percent sunlight at the surface to lesser amounts as you descend to the ocean floor. There is no accurate way for the general photographer to know exactly what colors are getting through at what depth.

This also applies to electronic flashes, which are daylight balanced. When flash is used in close for macro, there is some loss of certain colors. As



Wide-angle with flash K25



K64



Wide-angle without flash K25



K64

UNDERWATER

Text and Photography by Jack and Sue Drafahl



1:2 Macro with flash K25 at f11



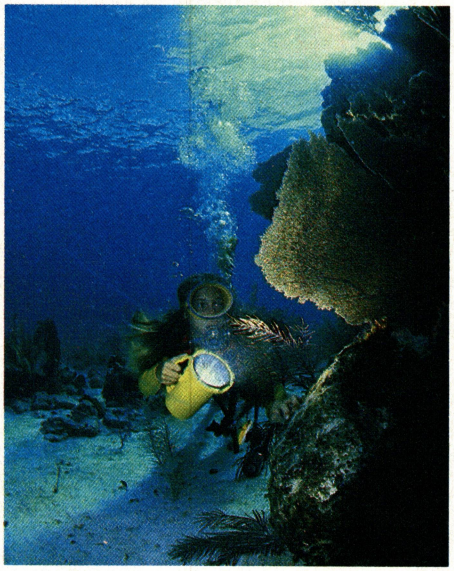
K64 at f16



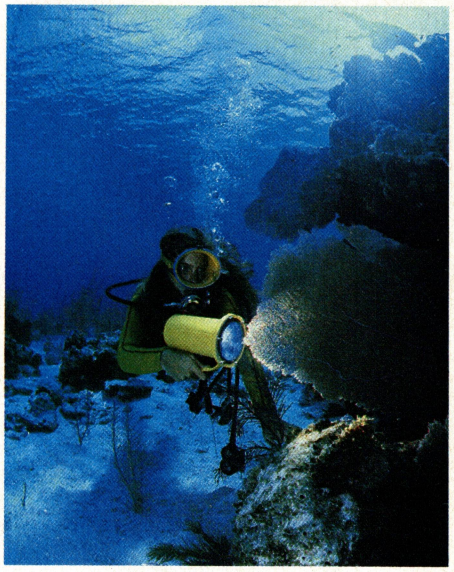
E64 at f16



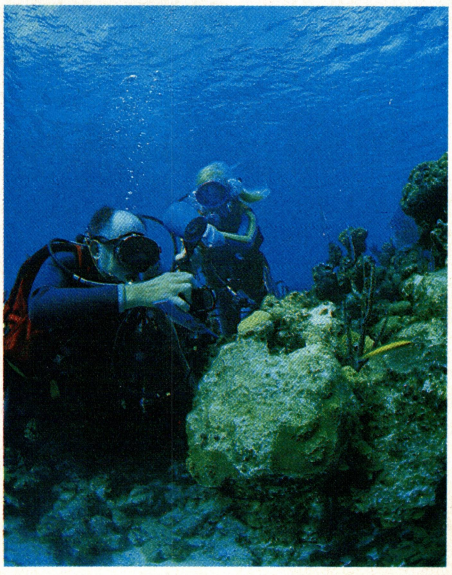
E64



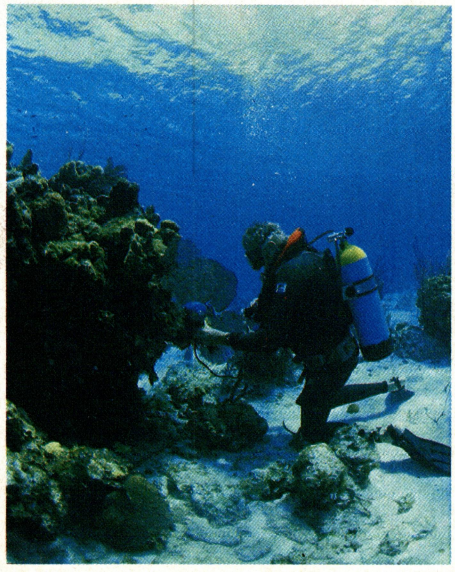
E200



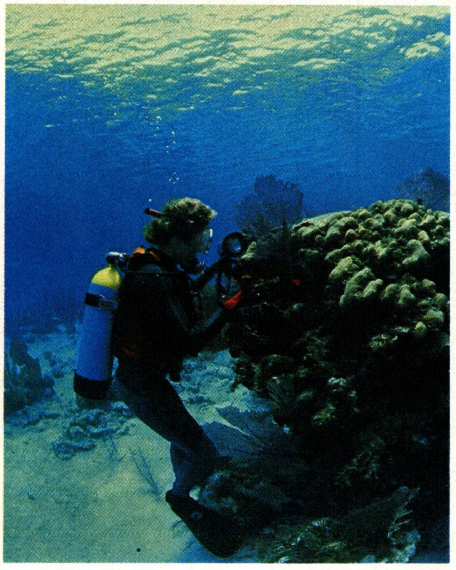
E400



E64



E200



E400

For a really complete outfit, you'll want 11 more accessories.





Under water or high and dry, all the gadgets in the bag depend upon the first accessory. Film. And Kodak arms you with eleven different 135-size films, each with special capabilities to help you match your mind's eye. To help capture total brilliance, there are six choices for color slide work. For color prints, there are two options, including our fast 400. And there are three different B&W films, including famed Kodak Tri-X film. Try them. Learn them. Use them to complete your outfit.

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TEST RESULTS

Test	Kodachrome 25	Kodachrome 64	Ektachrome 64	Ektachrome 200	Ektachrome 400
Shadow Detail	Good	Poor	Excellent	Good	Poor
Contrast	High	Very High	Medium	High	High
Sharpness	Excellent	Good	Good	Good	Acceptable
Grain	Extremely Fine	Fine	Fine	Medium	Coarse
Exposure Latitude	+/– 2/3	+/– 1/3	+/– 1 1/3	+/– 1	+/– 2/3
Water Color (0-30 feet)	Blue-Green	Blue-Green	Blue	Blue	Blue
Water Color (30 + feet)	Deep Blue	Deep Blue	Deep Blue	Deep Blue	Deep Blue
ASA—Film Speed	Slow	Medium	Medium	Fast	Extremely Fast
Film Sizes Available	135	110, 126, 135	110, 120, 126, 127, 135 and Sheet	120, 126, 135	120, 135
Processing Available	K14 Commercial Process Only	K14 Commercial Process Only	E6 Commercial or Home Process	E6 Commercial or Home Process	E6 Commercial or Home Process
Macro w/Flash Red Reproduction	Excellent	Excellent	Excellent	*NR	NR
Macro w/Flash Green Reproduction	Good	Good	Excellent	NR	NR
Macro w/Flash Blue Reproduction	Good	Good	Excellent	NR	NR
Macro w/Flash Warm Pastels	Excellent	Good	Good	NR	NR
Macro w/Flash Cool Pastels	Excellent	Good	Good	NR	NR

Special Note:
Some animals react to electronic flash differently than others especially at the infrared and ultra violet ends of the color spectrum. This reaction is accurately recorded on K25 and K64, but not on E64. Underwater photographers will never know which animals react in this way until this film is processed. The purple tipped sea anemone found in the Bahamas is one example. On Kodachrome it recorded cream colored tentacles with purple tips, but on Ektachrome it recorded green with purple tips. Of the several hundred animals photographed for this film test, less than five reacted in this way.

*NR = Not Researched

This chart summarizes the performance of each color film in each area tested. The results show no single film is always best.

the flash moves further away from the subject, such as in wide-angle shots, a different portion of the light is missing.

The color chart is also designed to reflect the various colors in the visible spectrum — cyan, magenta, yellow, red, green and blue, when in actuality many of the underwater animals photographed reflect the ultra violet (UV) or infra red (IR) part of the spectrum. UV is at the blue end of the spectrum and IR is at the red end. Both IR and UV are not visible to the eye or to the color chart, but can be reflected or absorbed by the animal life on the ocean floor.

Color film reacts to UV and IR and this affects the photo's final color, so the only possible way to get satisfactory results is to test the ocean itself. We photographed typical underwater scenes, with different films — at the same time, using the same lighting, location, angle and proportion. Underwater photographs are generally divided into three groups: wide-angle with flash, macro with flash, and available light. Comparisons were run in each of these areas repeatedly by various photographers. Different processors were also used in order to eliminate the possibility of inaccurate processing. The photographer can now compare the results and pick the film that he or she feels recorded the scene most accurately.

SHADOW DETAIL

This should be considered one of the most important categories. Much of the detail found in underwater photographs is in the shadows or secondary areas. Without these areas many photographs would lose their impact. E64 seems to be the champ in this category as it has great detail in the shadows and yet still maintains good highlights. When K64 and E 400 are correctly exposed for the highlights, they have almost no shadow detail.

CONTRAST

The amount of tonal gradation between the highlights and shadows is referred to as contrast. Many tonal grades indicate low or medium contrast, while few tones constitute high contrast. E64, with its medium contrast has the ability to pick up subtle tones much better than K64, with its high contrast.

SHARPNESS

Sharpness is the ability of a film to define an image clearly. Sharpness in a film also depends on contrast, grain, film speed and film thickness. Taking all these facts into consideration, you will find that K25 is superior. K64 and E64 come in a close second and should not be discounted.

GRAIN

Grain in color film is not the same as in black and white which has silver grain particles. In color film the final image is made up of three layers of color dye. These microscopic patches of dye are grouped together to form what looks like parts of out-of-focus grain particles. K25 has the finest dye grain pattern and therefore allows the largest possible enlargement. K64 and E64 are tied for second.

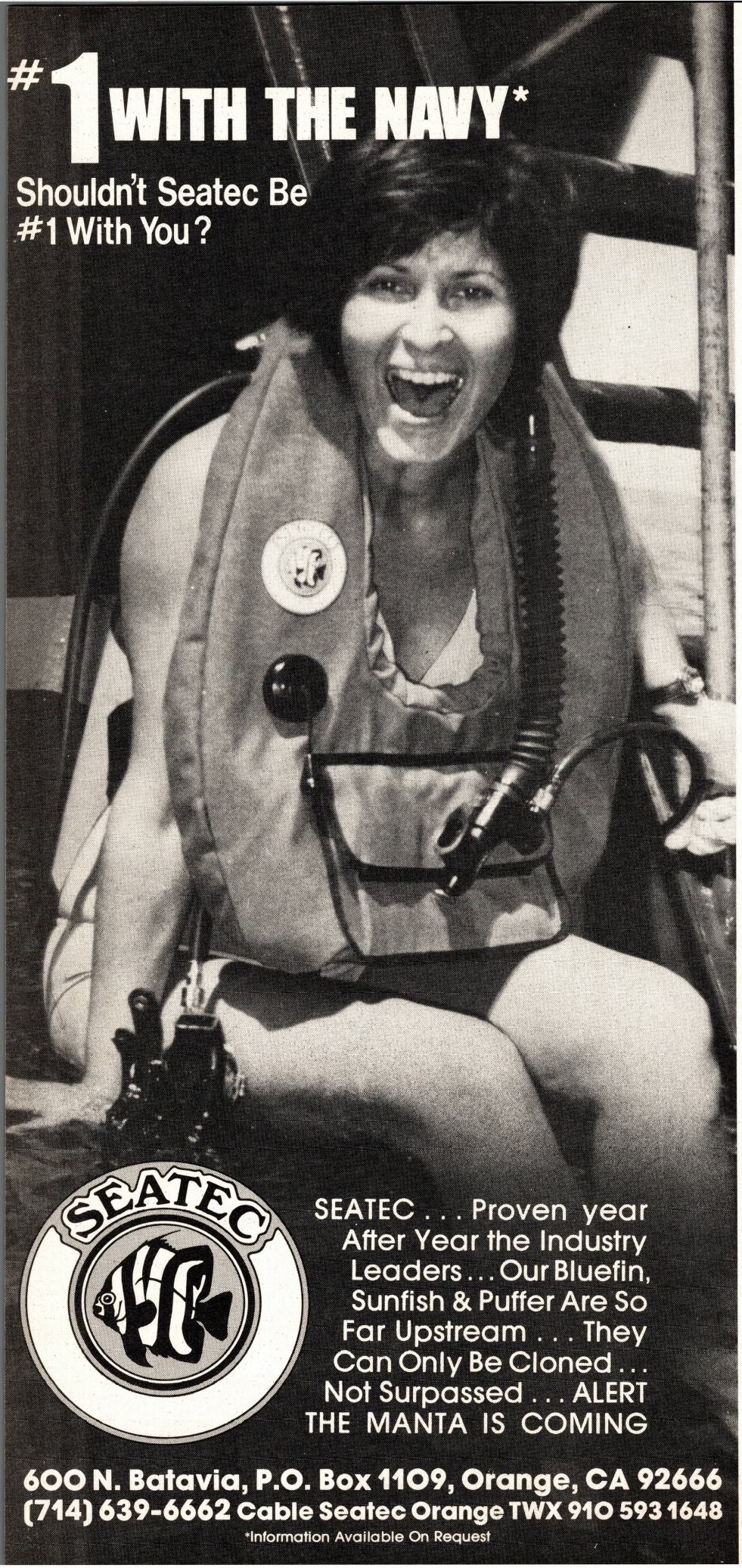
WATER COLOR

This was a special test showing how each film recorded the blue water background found in so many wide-angle photographs. Deep blue is considered by many photographers to be ideal. Since the Kodachromes are more sensitive to the warm colors they pick up more reds and yellows between 0 and 30 feet. This turns water blue-green at these depths. The less red sensitive Ektachromes produce a deep water blue.

EXPOSURE LATITUDE

A film's ability to accept over and under exposure and still be usable is called exposure latitude.

Correct exposure of film underwater can be difficult, therefore you need a film



with the greatest exposure latitude. E64 has the greatest latitude of +/– 1 1/3 stops, while K64 with its +/– 1/3 stop does not allow any room for error.

ASA

This rating indicates just how sensitive film is to light. For example, K25 is not very sensitive to light while E400 is extremely sensitive. When plenty of light is available, as in a shallow dive, low ASA film such as K25 or E64 can be used. Deeper dives provide less light and may require faster films such as E200 and E400.

MACRO PHOTOGRAPHY WITH FLASH

This comparison showed how well the different film recorded red, green, blue and pastels when a flash was used for close-ups. E200 and E400 were not recommended for these tests as they are too sensitive to the light flash produced this close. E64 did very well; with reds, greens and blues, but had some difficulty with pastels. K25 and K64 did well with reds and pastels, but had some difficulty with blues and greens.

AVAILABLE LIGHT

This comparison showed how each film performed when filtered sunlight was the only light source. Again, the water recorded on Kodachrome tended to be warmer at the shallow depths. K25's low sensitivity to light restricted it to shallow diving where enough light was present to record an image. E200 and E400's high sensitivity allowed divers to go much deeper and yet maintain good exposure control with a lot less light.

CONCLUSION

After carefully looking at the results of each test, it should be clear that no one film is the winner. Some films perform better in one category. If you could only take one type of film on a dive trip, E64 would have to be your choice. It has excellent shadow detail, and its sharpness and contrast are good. Its water color is excellent and it works well with flash. You can process it yourself or have it processed while on your dive trip in order to see how you are doing. Its medium speed allows divers to work shallow as well as at medium depths. E64 can be found in all film sizes, especially important to 2¼ inch format fans, and it can even be bulk loaded for economy.

For the diver able to take several types of film on a dive trip, E64 is recommended for all wide-angle shots with or without flash. K25 is suggested for macro, if your flash is powerful enough to illuminate the scene. E200 should be

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WEIGHT IN WATER
Approximately one ounce

ANGLE OF COVERAGE
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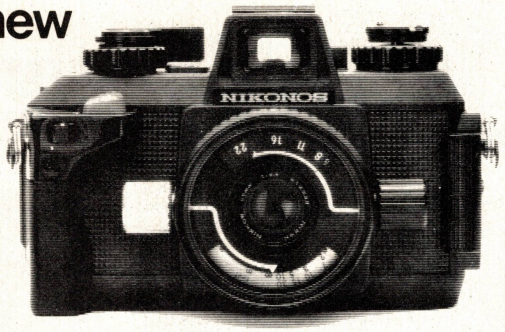
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COLOR FILM UNDERWATER

taken just in case the light level is very low or your flash has very low output.

Of the two remaining films tested, K64 is contrasty and requires extreme accuracy in exposure. As for E400, if a photographer cannot get correct exposures using E200, then going to E400 will probably not help.

It should be understood that these comparisons are only valid underwater and should not be used as a basis for film selection on land.

For underwater photographers to get the most from these comparisons, they must first evaluate their own photographic film requirements. By comparing these requirements to the characteristics of each film, they should then be able to select the proper film and feel confident with their choice.

BORGES APPOINTED PRESIDENT

N.A. "Tim" Borges has been appointed president of Sherwood Selpac Corporation, a wholly-owned subsidiary of Hill Acme Company, according to A. C. McDaniel, Hill Acme president.



Borges succeeds L. Orin Lindquist, who resigned to become a consultant to several companies. Lindquist will continue his association with Hill Acme in a special projects capacity.

Sherwood Selpac Corporation, located in Lockport, New York, is one of the nation's leading producers of compressed gas, LPG and scuba gas control equipment.

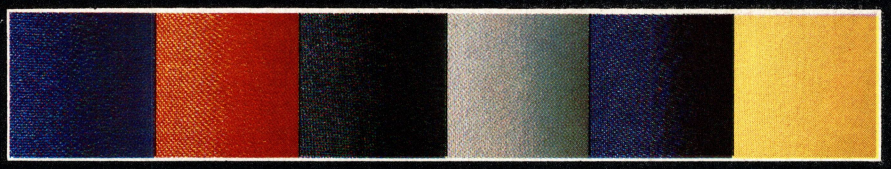
NIKON PROFESSIONAL SERVICES

William H. (Bill) Pekala has been appointed manager of Nikon's expanding Professional Services Division. Mr. Pekala had been field manager of Nikon Educational Services for the past three years and replaces Ms. Marci Robbins, who recently left the company to pursue other activities.

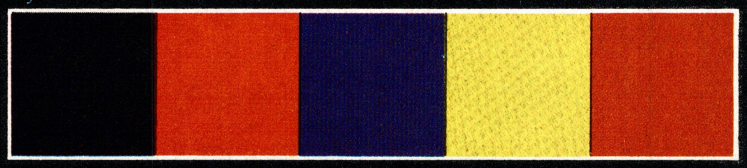
Since its formation in 1973, Nikon Professional Services has been an integral part of Nikon's strong commitment to support the professional photographer. NPS can be contacted at (516) 222-0200.

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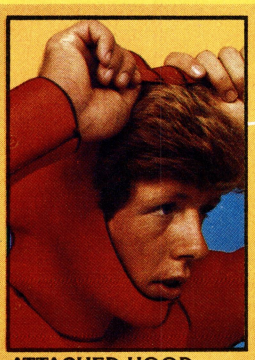
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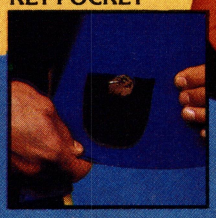
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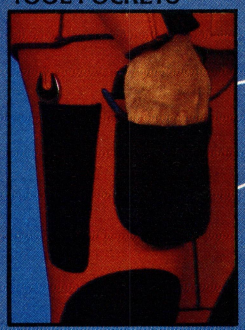


ATTACHED HOOD

KEY POCKET

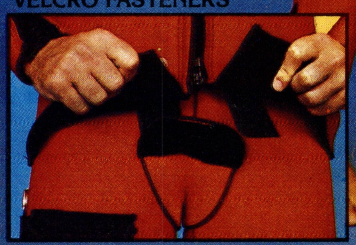


TOOL POCKETS



BELLOWS POCKETS

VELCRO FASTENERS



SPINE PADS

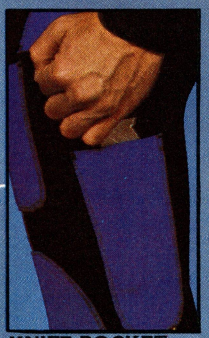
SWIVEL LOCKS



ELBOW PADS



THIGH POCKET



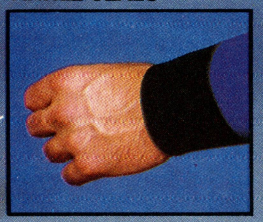
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The CDC training course will include special emphasis on the equipment, systems, techniques, procedures, and underwater conditions encountered by commercial and industrial divers. The Coast Guard Safety Inspectors will receive both theoretical and practical training in air, mixed gas, bell/saturation, underwater welding and burning, dive medicine, safety and emergency procedures, underwater explosives, and hyperbaric chamber operations as well as other highly specialized related subjects.

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The *Charisma*, California's newest dive boat, is 78 feet long by 25 feet wide. She has two main bunk areas and six private staterooms. She features circulating tanks to keep game alive, walk-in game freezers, a large sundeck, four hot showers, color television, stereo sound system, lots of electrical outlets and a galley large enough to seat everyone at once.



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A monthly calendar, showing planned trips aboard the *Charisma*, can be obtained at your local dive shop.

DIVER MEDICINE COURSE

North Ridge General Hospital is sponsoring a course on dive medicine for physicians, nurses and other medical personnel on Saturday, May 16. The course is intended to raise the level of awareness of physicians and other personnel to the medical problems encountered by skin and scuba divers.

Guest faculty include Charles V. Brown, M.D., from California and Bruce E. Bassett, Ph.D. from Texas.

The fee for this six hour course is $45. An optional post-seminar dive trip is planned for Sunday, May 17. For information contact North Ridge Hospital, 5757 North Dixie Highway, Fort Lauderdale, Florida 33334, or phone (305) 776-6000.



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We know of no other watch today that combines the features and design of the CASIO Watersports Alarm Chronograph. Features such as simultaneous time and date display, a daily alarm, time signal, countdown alarm and a stopwatch. These features are just the beginning. Compare them with any other watch in the world and you'll be convinced there is not a better watch for your money anywhere.

TESTED TO OVER 300 FEET OF WATER.

Three years ago, there were no digital water resistant alarm watches. Today they exist costing $200, $300 or more, but even these are rarely submersible beyond 100 feet of water. The CASIO Watersports has been tested to over 300 feet!! The O-ring construction and mineral glass crystal provide a tight seal which is virtually impervious to water or moisture.

THREE MEMORY ALARMS.

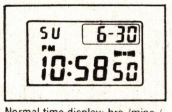
With this CASIO wonder you have not only one . . . or two alarms . . . but three separate, convenient reminder systems. You can set the daily alarm at precisely the minute you choose. The second alarm can be set to chime at every hour and half-hour. The third alarm is a countdown timer alarm which can be set at any position from 1 minute to 11 hours 59 minutes. And because of the convenient "PM" indicator, you won't be setting your alarm for the wrong time of the day.

PROFESSIONAL STOPWATCH.

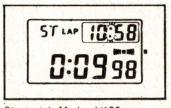
With the press of a button you can set a full-featured stopwatch in motion. Record split times, 1-2 finishes, or freeze the figures anytime to 1/100 second accuracy. In addition, to verify that you have stopped or started your stopwatch, a "beep" sounds. Plus another "beep" sounds at ten minute intervals during timing.

UNIQUE DISPLAY FEATURES.

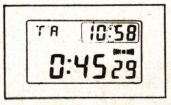
Another advantage of this unique timepiece is that it keeps continuous display of the time no matter what mode is being used. This unique 12-digit LCD display guarantees you'll never lose track of the time. With the touch of a button, you can instantly have 24 hour European/Military time. Quartz accuracy to ±15 seconds per month and a 5-year lithium battery tops off its list of features.



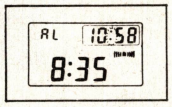
Normal time display: hrs./mins./secs., AM/PM, day, month, date, and 12/24 hr. time



Stopwatch Mode: 1/100 sec. timing, auto startover at 1 hr. lap time, lap and 1-2 finishes, normal time in upper corner



Countdown Alarm Display: Set from 1 min. to 11 hrs. 59 min., audible beep lasting 30 sec., normal time in upper corner



Alarm Setting Display: Set for AM or PM, alarm sounds for 30 sec., normal time in upper corner

THREE CHOICES OF STYLES.

No other watch on the market today can match the aquatic abilities, convenience and stylish good looks of this superb timepiece. Three Watersports models are available. The featherweight, all black polysulfone Watersports W-100 is available for $39.95, the Watersports W-150C with solid stainless steel case and tough black polysulfone band is available for $59.95, and for $69.95, you can own the Watersports W-150 with solid stainless steel for both the case and band.

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We can generally get your watch on the way to you upon receipt of order. (Other mail order suppliers generally state "prompt delivery," but with many this means 2 to 4 weeks before shipment.) We also offer you a 30-day money back guarantee, and CASIO gives you a one year manufacturer's warranty.

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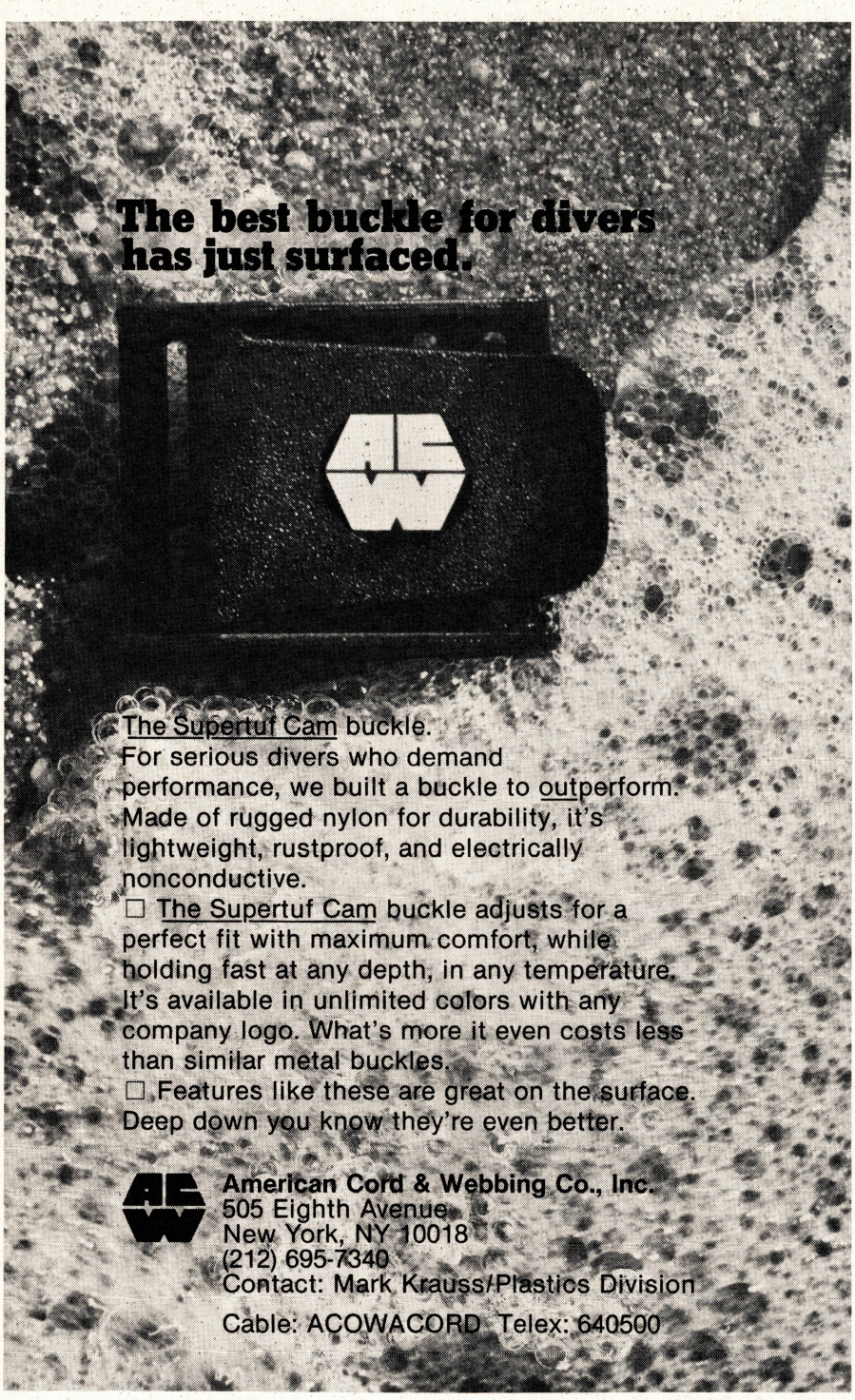
To order your Watersports watch, call the toll-free number below or send a check or money order for the total amount **plus** $2.50 for the first watch, $1.00 for each additional watch. If ordering by telephone, please have all the necessary information ready. If you wish, we will send your watch to you via U.P.S. **BLUE LABEL** 48-hour delivery for an additional $2.00. Minnesota residents add 4% tax.

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TREASURE HUNT

Divers Unlimited, of Hollywood, Florida, is sponsoring its Seventh Annual Free Treasure Hunt on Sunday, June 7. This activity draws divers from all over the country to compete for thousands of dollars in prizes. Last year, 1452 divers participated.

Participation in the hunt is free, but all divers must be certified. C cards are checked during mandatory pre-registration at Divers Unlimited prior to the day of the hunt. All divers must have a BC, a pressure gauge and a buddy. All teams (limited to three divers per team) must have a divers flag.

A final registration will be held Sunday morning from 9:00 to 9:45 am on the beach. This will consist of all pre-registered participating divers reporting in and being clocked into the water. At 9:45 am the competition dive boat will cruise a 20 foot deep reef 50 yards offshore. Over 200 three inch numbered treasure discs will be scattered along the reef, each representing a prize.

The Treasure Hunt lasts from 10:00 am to 12:00 pm. Upon leaving the water, all divers are once again required to report to the safety desk to be clocked out.

Winners are allowed to redeem only one treasure disc per person. All unregistered divers are automatically disqualified. Prizes this year will include several trips to the Bahamas, tanks, regulators, boat trips, air cards, masks, fins and dive knives.

For more information, contact Divers Unlimited at 6023 Hollywood Blvd., Hollywood, Florida 33024, or call (305) 981-0156.

M/Y MOONLIGHT

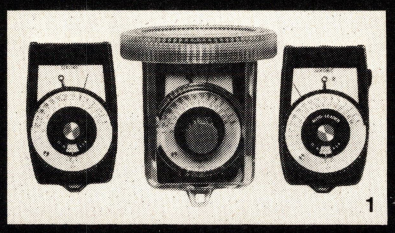
Atlas Leisure, Inc. announces the weekly departures of the 115 foot M/Y *Moonlight* from her home port of St. Vincent in the Windward Islands. She is completely outfitted for scuba diving. Itineraries include the wrecks of Dominica, drift diving off Tobago, and the islands of Bequia, Mustique, Carriacau, Grenada and more.



Individuals may book separately or groups of up to 15 can charter the entire yacht. Bar, lounge, scuba area, gambling and on-shore excursions provide an interesting dive/travel week.

For information and reservations please contact: Atlas Leisure, Inc., 15 West 44th St., New York, N.Y. 10036; (212) 997-1290.

New Gear



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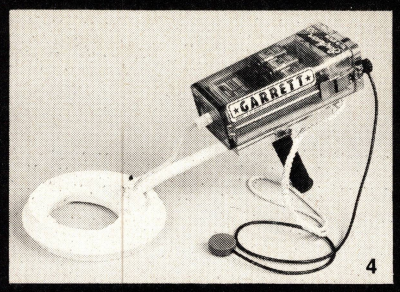


3

1 All Weather Underwater Meters — The Sekonic L-158 and L-188 light meters are now available in underwater housings that withstand water pressures of up to 200 feet. The L-158WH meter and housing is priced at $52, and the L-188WH retails for $68. Both from Copal Corp., 58-25 Queens Blvd., Woodside, NY 11377.

2 Florida Keys Dive Map—Illustrates the best dive areas, hotels and dive shops, ringed by the beautiful U/W photos of Jerry and Michael Greenberg. A set of six posters including this one is $18 and postage is prepaid in the U.S. and Canada. Seahawk Press, 6840 SW 92nd St., Miami, FL 33156. A complete color catalog is $2.

3 Dive Light Holder—Made for use with the Tekna Lite II, the holder allows the diver to attach the light securely when necessary or remove it at a moment's notice. The 2 inch long, neoprene clamp with velcro strap can be mounted on an arm, leg or camera equipment for easy access. $7.95, available from your nearby Tekna dealer.



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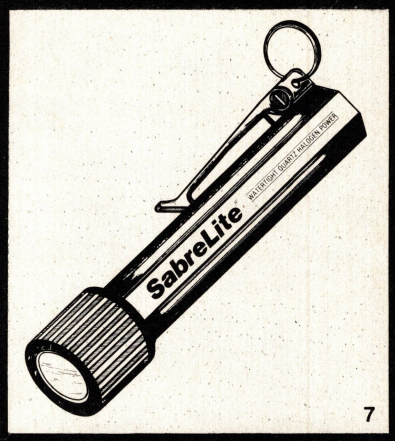


6

4 U/W Metal Detector—Remarkably easy to operate, the unit is capable of excellent performance in both fresh and salt water. It can be used to find coins, relics and larger objects buried several feet down. Total automatic tuning. $499.95 from Garrett Electronics Inc., 2814 National Drive, Garland, TX 75041.

5 Custom Tanks—Express yourself with a personalized tank. Make a selection from one of several stock designs — Coors, Budweiser, Coca-Cola or Michelob — or choose your own design. The customized cylinders come in either aluminum 80 or aluminum 50 for $225 each. Available from Kustom Tanks, Box 2397, Hutchinson, KS.

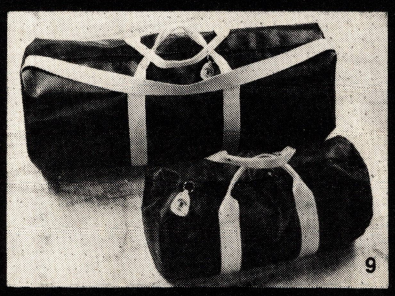
6 Swim Suits—Your choice of either 100 percent nylon or lycra swim wear. Styled for the active diver; double stitched and close fitting. Men's suits start at $10.95 and women's at $27. Suits are fully washable and fade resistant. Quality swim wear at a reasonable price. Available from Aqua-Craft, at your local dive shop.



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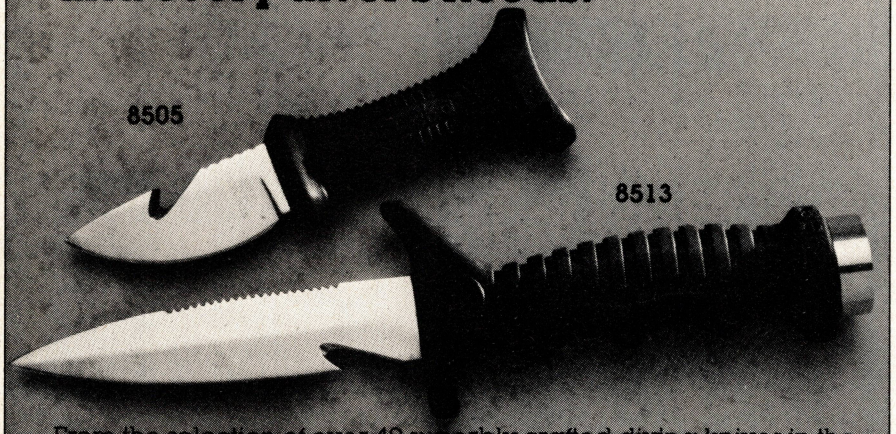
7 Dive Light—With a bright quartz halogen lamp or a conventional G.E. bulb, this light is designed to operate while using any C size ni-cad, carbon or alkaline battery. The Sabrelite is only 7½ inches long and 1¾ inches wide. Sabrelite System (with charger) is $65.95. Sabrelite alone, $29.95. From Pelican Products.

8 Bahamian Fish Poster—Over 50 beautiful Bahamian reef fishes are featured on this four color, artwork poster created by artist Idaz Greenberg. A set of six posters including this one is $18 and postage is prepaid in the U.S. and Canada. Seahawk Press, 6840 SW 92nd St., Miami, FL 33156. A complete color catalog is $2.

9 Mini Pocket Bag—A smaller version of the Pocket Bag, the mini measures 22 inches long by 11 inches in diameter. Made of heavy-duty neoprene coated nylon, double stitched, it comes complete with durable Delrin zipper and has five roomy pockets. $35 from Subsalve Industries Inc., P.O. Box 9287, Providence, RI.

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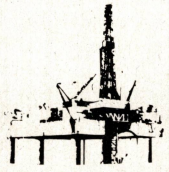
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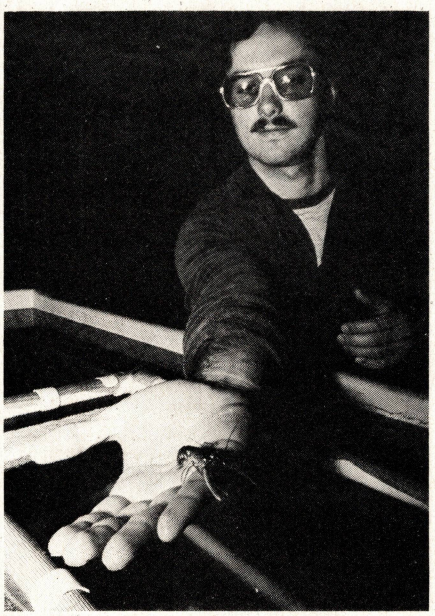
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Florida Institute of Technology's Environmental Technology, Aquaculture program gives students an opportunity to learn the theory of aquaculture. With its hands-on approach they learn the practical aspects also.

The F.I.T. crustacean aquaculture class this year, under the direction of Dr. Michael Hartman, received about 50 juvenile hybrid lobsters. These are a cross between a European lobster and an American (Maine) lobster.



Ken Sener, Aquaculture student at F.I.T., holds rare, juvenile hybrid lobster.

The crustaceans were bred at the University of California laboratory at Bodega Bay, California, 60 miles north of San Francisco. Doctor Hartman worked at Bodega Bay as an algal culturist and also worked in the development of a hatchery scheme for crabs at that institution.

M/V SEA FOX

The North Carolina coast has long been noted for its Gulf Stream diving. Nags Head Divers has just launched a new 50 foot custom dive boat, the M/V *Sea Fox*, to run trips to the numerous wrecks along the coast.

Nags Head Divers has two dive shops in the area — one at Mile Post 10.5 Nags Head Beach, and another at Pirates Cove Marina on the Nags Head-Manteo Causeway. Captain Jim Stuart and Fil Nutter are your hosts to this world of excitement.

For more information contact: Nags Head Pro Dive Center, Box 502, Nags Head, North Carolina 27959; (919) 441-7594.



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HAMMERHEADS

BY THE HUNDREDS

Text and Photography By Howard Hall



Hundreds of hammerheads schooling in the Sea of Cortez.

As I lay on the surface hyperventilating, I stared at a point directly below where shimmering rays of sunlight converged on my shadow. I was trying desperately to relax; to slow my heart rate to normal or, hopefully, even slower. Years of experience had taught me how much hyperventilation I could tolerate before passing out during my ascent. This dive, however, was important and I had no idea how many others I would have. I intended to press the limits a bit. The 16mm movie camera in my hand weighed 40 pounds above water and though it is nearly neutral in the water, I had to remember it would create considerable drag and account for that in my timing. Fifty feet below, the shadows were moving in my direction.

I took an extremely deep breath of air and then gulped several additional mouthfuls into my lungs, filling them to absolute capacity. Then as slowly and as efficiently as possible, I bent at the waist, raised my legs and dived. During the first 40 feet of descent, I closed my

eyes and listened to the sound of my heart as the pulse became slower and slower. Then after reaching a point where my buoyancy had become negative, I allowed myself to sink. Finally, at 70 feet I leveled out and slowly began swimming toward the approaching shadows. To get the best possible camera angle, I had to get below the school. As I looked up, I realized that, indeed, the school was going to pass right above me. I pointed the camera skyward and pulled the trigger.

It was like looking at a school of bait passing overhead. There were literally hundreds of them, but these were not tiny fish, these creatures were seven to ten feet in length. Even one of these massive animals normally produces terror in the hearts of inexperienced divers and, yet, directly above me were clouds of them. Clouds of hammerhead sharks!

I continued to film until the enormous school of sharks was directly above, but by then my breath was gone. The scene above was exactly what I had dreamed of filming for the last several months, but I had to ascend immediately or risk staying there indefinitely. I dropped the camera to my waist and began ascending directly into the school of approximately 400 hammerhead sharks that swam above me. Suddenly, I was inside the school. I wished that I could stop and film. The sharks were everywhere and very close; closer than I had hoped to get. But I couldn't stop. At this point, the effort necessary to raise the camera and film would be too costly.

As I turned, I saw that one shark was on a collision course with me! I hesitated for a moment and it passed over my head with only inches to spare. I hit the surface and took one breath and held it while the dizziness passed. The school of hammerheads was still below, but moving slowly away. I realized they would be gone before I could catch my breath and dive again. It might be hours or even days before I got another chance. But, fortunately, this dive had been productive.

Now, some of you reading this may think anyone purposely placing himself in a school of 400 hammerhead sharks must be quite insane. Certainly, hammerheads can be some of the most dangerous sharks in the ocean. But sharks, like all creatures on this planet, demonstrate a variety of behaviors and although they have been described as merely eating machines (that occasionally and indiscriminately eat people), recent studies by a variety of scientists have found them to be far more than that. Each species of shark has its own characteristic behaviors which vary with time of year, time of day, availability of food, and perhaps simply the shark's mood. In 1979 I became aware of studies being made on the schooling behavior of hammerhead sharks in the Sea of Cortez by Dr. Don Nelson, Peter Klimley and Jeremiah Sullivan. I had seen some tantalizing film footage shot by Dr. Ted Rulison showing these schools of sharks and I was intrigued. With the help of Stuart Goodman in New York and the staff of ABC sports, I assembled a film crew. In August of 1980, we set out to film these incredible animals.

The film crew assembled by Goodman and myself included some of the most impressive talents in the dive community. The principals in the film were to be author, Peter Benchley; underwater filmmaker, Stan Waterman; and the man who shot that first incredible footage of the schools, Dr. Ted Rulison. In addition to their responsibilities as on camera talents, Stan and Ted would also help shoot underwater film when possible. The bulk of the underwater filming fell to myself and Gordy Waterman. Although Gordy certainly got his start assisting his famous father, he is now a completely capable and very talented underwater cameraman in his own right. Footage produced by Gordy always seemed to complement my own and vice versa. And on those occasions both Gordy and I missed the best possible shot, Stan always seemed to get it despite his on camera priorities.

To film the hammerheads, we chartered Baja Expeditions' *Don Jose*. It was perfectly suited for our task. In August we traveled from La Paz to a tiny seamount north of San Jose Island. There we were to spend our next ten days searching for schooling hammerhead sharks.

We anchored the boat at 10:00 am. I got in the water with a mask immediately, followed by my assistant, Marty Snyderman. My excuse was that I wanted to check conditions and inspect the top of the pinnacle, but actually I was hoping to see a hammerhead or two right off. Producing a film like this is an expensive proposition and since success or failure depends entirely on the presence of the sharks, seeing one or two right off would greatly settle the nerves of both myself and Stuart Goodman. I reached the anchor line and looked down through the clear water to the peak 60 feet below. Immediately, I saw six hammerheads pass over the seamount and disappear into the deep water on the far side. I signaled Marty to return to the boat; we had been in the water five minutes.

The concept of the film (at this writing it was scheduled to air in April) was to photograph Stan, Peter and Ted diving among the schooling hammerheads. After the dives Dyanna Taylor and Dave Conley filmed the three as they discussed their experiences and speculated on the reasons for sharks' behavior. These discussions were recorded on tape by our sound man, Steve Gagne. But, the Sea of Cortez seamount proved so dramatic that the schools of sharks were only shown several times in the film. In addition to swimming amid hundreds of hammerhead sharks, we also filmed sailfish, marlin, sea lions, tuna, and an amazing encounter with a giant manta ray which encouraged us to ride upon its back! We had brought far more film than we thought we could use, but we returned without an unexposed frame.

As I look back on the expedition now, however, the single most impressive sight is still that silhouette of literally hundreds of hammerhead sharks hanging above me as I held my breath at 70 feet. The idea of such an experience would have scared me to death at one time in my dive career. But I have learned much about sharks in recent years. I now know that many of the classical concepts of this wonderful creature are invalid. Certainly sharks can be dangerous, but not all species of sharks. And those that must be considered potentially dangerous may not be dangerous at all times. The reasons these animals occasionally bite humans may be far more complicated than we suspect.

The case of the schooling hammerheads is especially interesting. During this type of behavior, the sharks seem totally non-aggressive to, or even shy of, divers and they don't seem to be attracted to baits. Dr. Nelson, Peter Klimley and Jeremiah Sullivan have been studying this behavior for several years. Although they suspect schooling may be related to mating, they have found very little proof. As yet, the answer is far from clear. Normally, sharks don't school.

This species of shark (the scalloped hammerhead) can be dangerous during other moods, however. Several years ago while we were filming blue sharks off the coast of San Diego, a scalloped hammerhead came in and attacked cameraman Larry Cochrane. He survived by inserting his movie camera into the shark's mouth each time it tried to bite him. Since the camera was running at the time, the incident produced a rather dramatic piece of footage. Although this shark came in eagerly to bait, the sharks in the Sea of Cortez were not interested by baits we placed on the top of the seamount even when they swam right over them.

The ten days I spent in the Sea of Cortez during this film expedition were perhaps the most memorable days of my dive career. Each of us made dozens of dives and on each dive we saw hammerheads; often dozens of them. In fact, it is really something to dive in an area, watching manta rays, billfish and schools of hammerhead sharks passing by. It is experiences like this that make scuba diving the most wonderful way of life on earth.

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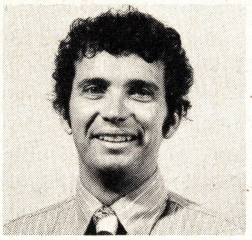
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DELTA AIR LINES

WALSH JOINS AQUA-CRAFT

Dan Walsh has joined Aqua-Craft, Inc. as promotion and advertising manager, company president Bill Martin announced recently. Walsh's duties will include development and management of advertising programs, marketing statistics, new products, and phone sales



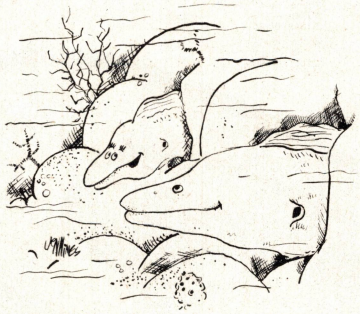
campaigns. Additionally, he will be working on production of the popular Aqua-Craft Industry Newsletter, which will be making a comeback soon. Walsh encourages dive stores, tour operators and others in the industry to direct inquiries, information, and pictures for the newsletter to him at Aqua-Craft, Inc., 7992 Miramar Road, San Diego, CA 92126. Call him at (714) 271-7000.

DIVE MUSEUM

The Institute of Diving, founded in 1977 by a nucleus of retired Navy divers including Captain George Bond and Bob Barth, is a non-profit organization working toward the establishment of a museum dedicated to the history of diving. Plans include exhibits on technical accomplishments in both commercial and general sport diving.

The Institute has an ongoing regional education program and sponsors meetings to discuss diving. These are all conducted by industry leaders and Navy staff members. The State of Florida is strongly considering a proposed Panama City site for the museum. The museum is sponsored through individual and corporate memberships and donations.

For membership information, please write: The Institute of Diving, Box 876, Panama City, Florida 32401.



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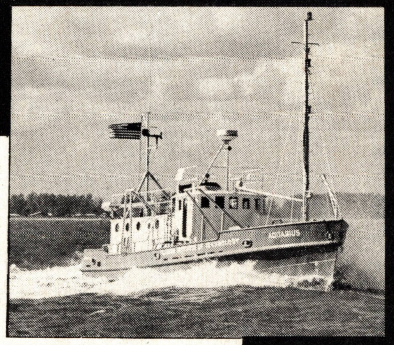
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The official drawing will be held July 15, 1981. Only fully completed coupons will be honored. This promotion may not be available in some areas. Void where prohibited by law.

All participating stores are listed by state, alphabetically by store name with city and phone number.

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1 Diving Unlimited
* Decatur
(205) 353-2940

5 Gulf Coast Divers Supply
* Mobile
(205) 661-2501

Southeastern Divers Inc.
Florence
(205) 766-3483

ALASKA

Alaska Diving Services
Ketchikan
(907) 225-2666

Alaska Mining & Diving
Anchorage
(907) 277-1741

Anchorage Dive Center
Anchorage
(907) 279-3483

ARIZONA

Desert Aqua Sports
Sierra Vista
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ARKANSAS

South Arkansas Dive Shop
El Dorado
(501) 862-0021

CALIFORNIA

Adventure Diving
Fresno
(209) 441-1191

Aloha Diving School
Burbank
(213) 846-1320

Aloha Diving School
Reseda
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Pacifica
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Aqua Divers Inc.
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Aqua Lung Center
Fullerton
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Aquarius Dive Shop
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5 Aqua-Ventures Diving School
* Camarillo
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Modesto
(209) 522-5465

California Pro Dive Shop
Hacienda Heights
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5 Cassotta Diving Inc.
* Rocklin
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5 Divers Den, Inc.
* Santa Barbara
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Divers West
Pasadena
(213) 796-4287

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Mountain View
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Fremont
(415) 791-1200

Innerspace Divers
Bakersfield
(805) 399-1425

Jim's Dive Shop & Sports
Atwater
(209) 358-7230

Malibu Divers
Malibu
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San Rafael
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5 Mother Lode Dive Shop
* Sacramento
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New England Divers
San Francisco
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Hayward
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Pinnacles Dive Center
Novato
(415) 897-9962

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Vallejo
(707) 644-4433

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Anaheim
(714) 956-5540

Scuba Schools of Long Beach
Long Beach
(213) 433-6765

Sports Cove
Vacaville
(707) 448-9454

Sea Wink Sporting Goods
Pismo Beach
(805) 774-4794

Tri-Valley Scuba School
San Ramon
(415) 828-5040

Ukiah Skin & Scuba
Ukiah
(707) 462-5396

Underwater Sports
Santa Barbara
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A-1 Diving Co., Inc.
Englewood
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Divers Reef, Inc.
Colorado Springs
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5 Odyssea Diving Center
* Aurora
(303) 751-4991

Rocky Mountain Diving Center
Lakewood
(303) 232-2400

Sea-Trek
Englewood
(303) 761-0371

CONNECTICUT

Orbit Marine Sport Center
Bridgeport
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Scuba Shack of Connecticut
Rocky Hill
(203) 563-0119

FLORIDA

American Divers Int'l.
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Aquifer Dive Center
Jacksonville
(904) 398-1274

Atlantic Scuba Academy
Daytona Beach
(904) 253-7558

Bill Crawford's Tropic Isle
Key Largo
(305) 451-1063

Charlotte Diver
Charlotte Harbor
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Cutler Ridge Diving Center
Miami
(305) 251-2710

Deep Six Dive Shop, Inc
Vero Beach
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Dive and Tour, Inc.
Deland
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Deerfield Beach
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* Hollywood
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5 American Dive Hawaii, Inc.
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Scuba Sports
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* Lafayette
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New Iberia
(318) 367-1836

Underwater World Scuba Facility
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Venture Sports, Inc.
Lake Charles
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5 Underwater Works Limited
* Columbia
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(206) 373-6141

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5 Blue Water Divers Inc.
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Duncan Scuba Sea Ltd.
Duncan, BC
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Orillia, Ontario
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Richmond, BC
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Mundo Submarino, Inc.
Rio Piedras
791-5764

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Divemaster PTE. Ltd.
Singapore
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Singapore
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Alpin & Dyksport
113 69 Stockholm
(31) 9494
Aquanaut Dykmateriel AB
102 61 Stockholm
(40) 7155
Aqua Sport VD/AB
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For Whom the Bells Toll

BY CHRISTOPHER SWANN

The year was 1968. There we were, two Frenchmen and an Englishman, crammed into an ocean-going version of a space capsule, suspended 260 feet below the deck of a drilling ship. The water was clear. Through the ports we could see the coarse sand bottom and, 30 feet away, the shattered remains of an experimental explosive anchoring system, the object of our dive. We were geared up and ready to go.

The test program was not going well. The week before a similar unit had failed to detonate and, thanks to a recalcitrant winch, we were forced to make a bounce dive using scuba tanks filled with mixed gas to shackle another cable onto the unit. The dive had not been made without a good deal of soul-searching. The device had been resting on its trigger — a rod which, on contacting the bottom, set off a charge which fired a harpoon into the sea bed. The heave-compensator on the winch was still functioning so we took comfort in the fact that the cannon would not be bouncing on the bottom with the rise and fall of the ship. In spite of this, thinking of our heirs, we had negotiated a bonus before making the plunge.

The tender opened the blow-down valve and the roar of high pressure gas hit us like a sledge hammer. We equalized the pressure on our ears intermittently while our voices became squeaky in the helium atmosphere. The needle on the internal gauge moved steadily around the dial. Suddenly there was a noise like a gun going off and we were showered with tiny pieces of glass. A pressure gauge had blown out. We continued on down while the needle moved past 250 feet.

The hatch dropped open and the first diver slid through the trunk into the water. I followed quickly, leaving the tender in the bell. The water felt good after the clammy atmosphere inside. I unhitched the camera from the outside of the bell and swam after my companion.

A strange feeling began to come over me. It was almost as if I were being asphyxiated, yet I had ample gas and was breathing normally. My eyes started to play tricks on me and my field of vision narrowed. I continued swimming, wondering what was happening. I had no



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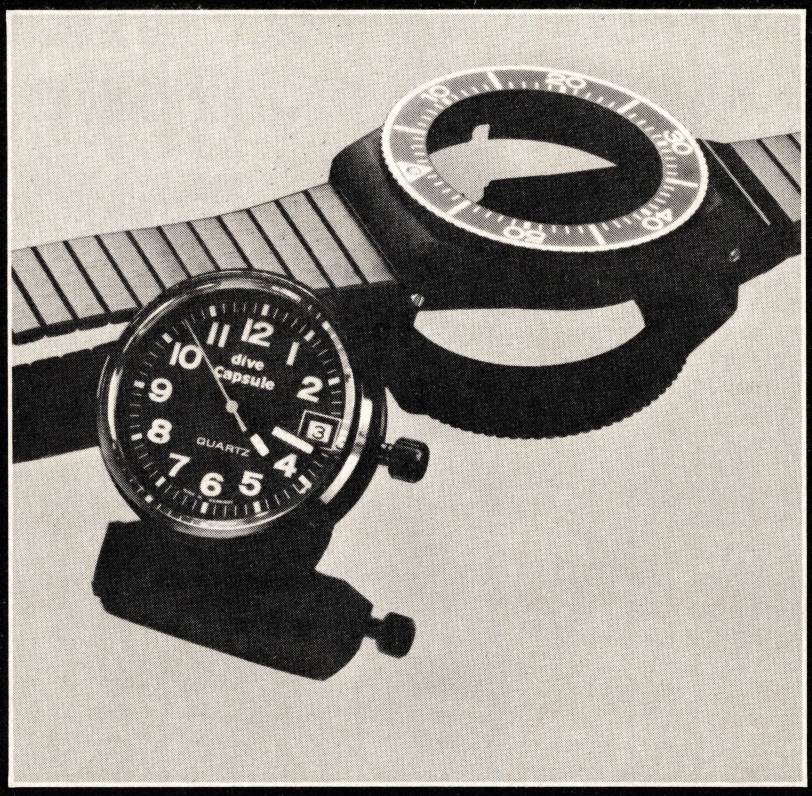
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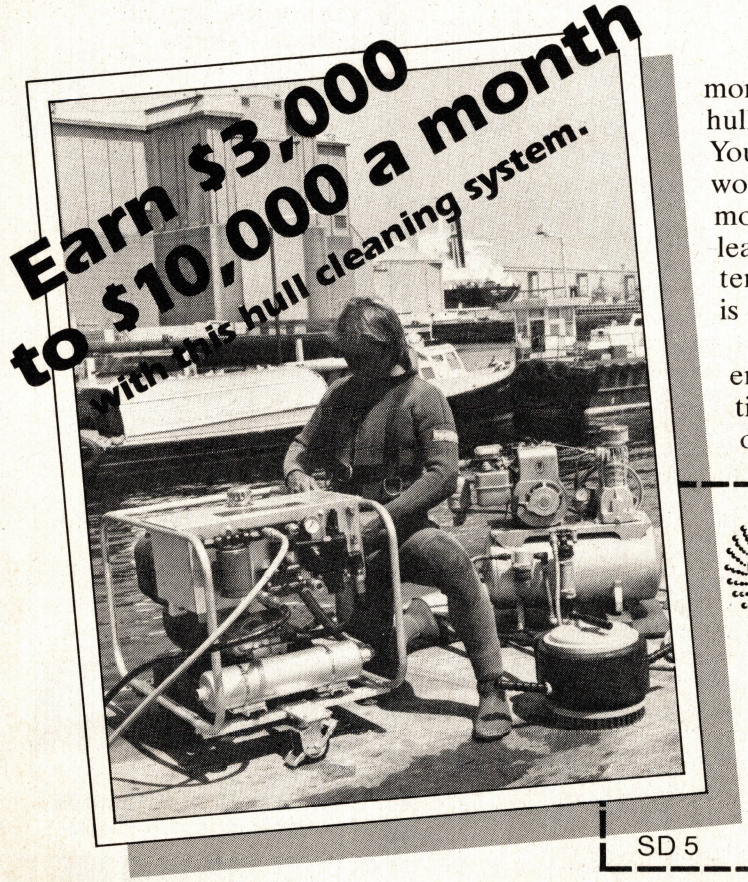
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SD 5

way of communicating with the bell except by the hose being steadily paid out behind me.

I was almost at the wreckage of the anchoring system when the tunnel vision and sensations of asphyxia became worse. I glanced over at my companion. He was preoccupied with shackling the lifting lines to the pieces of twisted metal and seemed all right. I decided to abort the dive. I tugged on my hose, signaling I was returning.

As I reached the bell I became dizzy and disoriented. I felt I might pass out any minute. I pushed the camera up through the hatch, then quickly pulled myself inside. I began talking to the tender in English, oblivious of the fact that for months I had spoken nothing but French. He looked puzzled. "*En francais, en francais*," he kept saying. Gradually my mind cleared and I was able to explain to him what had happened.

Soon the other diver returned. There was a short discussion with the surface: the supervisor wanted him to go back to the job. He began complaining, saying that he had taken enough. This was very unlike him. He was usually a tireless and good-natured worker. Suddenly his body went rigid, his eyes rolled back and convulsions seized him. We grabbed him quickly, pulling him up into the bell. Luckily he was small because it was already cramped without one of us being unconscious.

The bell started up toward the surface, venting gas through the open hatch as it went. At 100 feet we stopped to close the inner hatch and seal the bell. Terrible groans were coming from the unconscious diver. To make matters worse, he began vomiting.

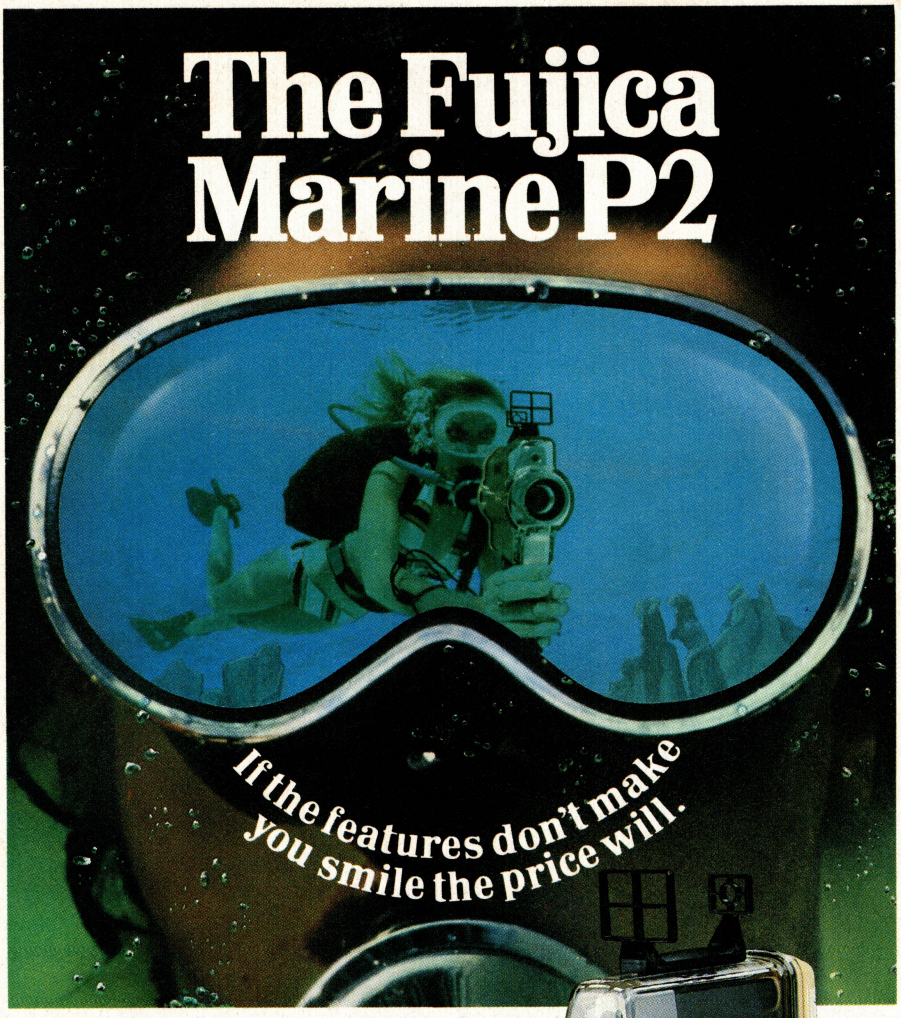
Normally, at this point in the dive, we would have begun breathing a 40 percent oxygen mixture from a BIB system to speed our decompression. Checking the manifold, the tender was faced with the awful truth. It was this first decompression mix that we had been breathing outside the bell. The equivalent of pure oxygen at a little over 100 feet!

The bell started up again. We glanced at the internal pressure gauge. It too was moving up. The hatch was not sealing. We told the surface to halt our ascent immediately. On opening the hatch, we discovered that the O-ring was peppered with fine glass particles and would not seal. There was simply no way to extricate them all. We would have to reclose the hatch and try to maintain our internal pressure by constantly adding gas until the bell was back on deck and locked onto the chamber. The alternative would be a spectacular onset of bends.

As we moved steadily toward the surface, I wondered how I had gotten myself



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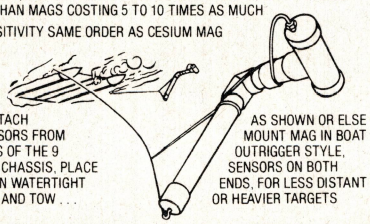
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into this situation. Here I was, jammed into a leaking diving bell with two other divers, one of whom was unconscious, along with a bulky camera, piles of hose and a liberal sprinkling of broken glass.

My mind drifted back to the day, not many months before, when I had walked into the company office looking for a job. At that time the dive industry was much smaller than it is today and openings were few and far between. The aspiring commercial diver, unless he had experience in one of the manual trades such as plumbing or welding, was lucky to get past the receptionist. Furthermore, a course at one of the few dive schools then in existence was no solution — the majority of the instructors were ex-Navy men with no experience in oil field practices. As a result, many graduates found that their diplomas were about as valuable as a roll of toilet paper.

In my own case, I already had several years of scuba diving behind me, mostly connected with photography, and I had some peripheral contacts with offshore oil. I also had an impressive-looking piece of paper announcing I had spent three weeks wandering about the bottom of a tank in hardhat gear. And a card that said I was qualified to teach other people how to scuba dive. I had never been in a decompression chamber, never seen the inside of a bell, never breathed mixed gas, never used any tools underwater except for a hacksaw and a hammer; yet I thought I knew quite a bit about the business of diving. Ignorance, of course, is bliss. That I was hired at all is explained solely by the fact that the company was not averse to taking sport divers off the streets in the hope that some, at least, would eventually make the grade.

We were nearing the surface now, our eyes riveted to the internal pressure gauge. The tender was opening the blow-down valve repeatedly to compensate for the leakage. Intermittent moans from the still unconscious diver added to the drama.

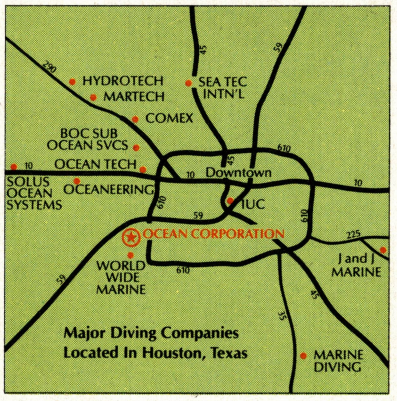
Soon sunlight flooded through the ports as we were lifted clear of the water and swung on deck. There was a slight jolt as the bell was lowered onto the chamber; then the sound of bolts going home as we were clamped onto the entry lock. Our worries were over!

In the chamber we feasted on bread and Camembert. An hour later our companion regained consciousness, complaining of a splitting headache. He remembered nothing about the dive, but quickly dispelled any fears that he might be suffering from amnesia by turning to me and repeating the only words of English he knew: "Eat! Drink! (expletive deleted)!"

Why Houston?

BECAUSE

The Ocean Corporation is located in Houston and more commercial divers are hired in Houston than in any other place in the world. Twelve diving companies are located in Houston including three of the four largest in the U.S. Many others are located in the nearby New Orleans area.The demand for divers is so great in Houston that large locally based diving companies like Ocean Systems, Hydrotech Systems, Martech International and Sea Tech International have hired many of our students for part-time work while they were attending school. Over 90% of our recent graduates went to work for these and other local diving companies when they completed our program. Houston is the place where the action is...the commercial diving, offshore construction and oil industry capital of the world.



BECAUSE

The Ocean Corporation is a commercial diving company, not just a school. Our facilities, equipment and training aids are the best, and our diving systems are as up-to-date as possible... because much of the equipment is used by our diving operations division to perform actual diving contracts in the field. Ocean Corporation has successfully completed many underwater jobs for various industrial clients over the years... including specialized underwater inspections, maintenance and repair work. For example, we did the world's first commercial underwater repair job in a nuclear power plant. And most of our divers have been graduates of our own school.



BECAUSE

The Ocean Corporation is a convenient and exciting place to go to school. Houston is one of the fastest-growing and most dynamic cities anywhere. It is a city of expansion, energy and youth (the average resident's age is in the mid-20's). Houston offers every conceivable kind of entertainment, from sports events, ultra-modern discos and open-air theater to rough-house local rodeos, chili cook-offs and the new Texas-size country-western dance clubs. Reasonably priced adult and singles apartments are readily available within walking distance of the school, and fast-food to luxury restaurants are nearby. The semi-tropical climate is wonderful, the sport diving is great and the folks are friendly.





BECAUSE

The Ocean Corporation management and instructor staff have long-term experience in the international offshore oilfield diving business. Retired ex-military divers and sport scuba divers don't run the school...*commercial* divers do. For example, the President of The Ocean Corporation, Larry Cushman, was Vice President and Europe/Africa Area Manager for Ocean Systems, Inc. for three years...with responsibility for all North Sea diving and underwater construction operations. He also worked six years as a manager for Oceaneering International, Inc., another of the world's largest commercial diving contractors. Ocean Corporation managers and instructors know today's diving business...first-hand, from recent experience.

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Santa Barbara, CA	*
Monterey, CA	22-30
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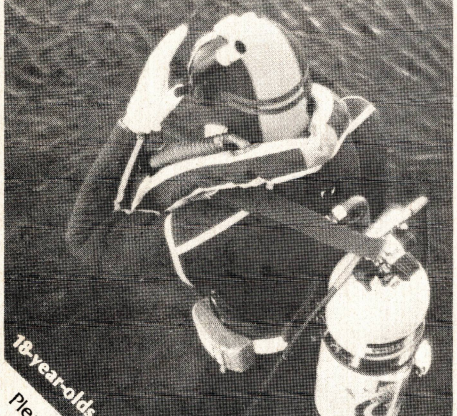
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Film Festivals 'n Symposiums

SEA 81 UPDATE

Saturday, May 2, 1981, is the date for Sea 81, the 17th Annual International Film Festival sponsored by the Underwater Photographic Society of Northern California.

This year's Film Festival brings to the stage the following notables: Jack McKenney, international cinematographer, with his latest film, *The Bahamas: Of Dreamers and Divers*; Al Giddings, underwater director, cameraman and one of the world's expert underwater researchers and filmmakers; and Academy Award winner, Robin Lehman, back again with another of his creative films. Lee Tepley, last year's NOGI award winner, will show his film, *Fire Under the Sea*. He will also be presented the NOGI Award during the evening. A true highlight of the Sea 81 evening will be Wesley and Connie Mueller who went to sea off



the Florida coast and filmed incredible footage of hand-feeding sharks, spiny lobsters and other fish feeding studies over 50 years ago! Now, 76 years old, they share with us an incredible color adventure underwater, 20 years before scuba and sophisticated underwater camera systems were ever invented.

Tickets will be available at local ticket agencies and the Paramount Theatre Box Office, 2025 Broadway, Oakland, CA 94612. For further information, contact Mike Williams (415) 692-7847 or 692-6173, or Ed Sheldon (415) 237-2207.

U/W SYMPOSIUM

The Massachusetts Maritime Academy Scuba Club will host an U/W symposium entitled Maritimes Underwater. It will be presented by the Massachusetts Maritime Underwater Society and will be held May 2 at Admiral Lee Harrington Hall, Buzzard Bay, MA.

The program will consist of U/W films as well as speakers who are experts in their areas.

Topics of interest will be Treasure Hunting, Sharks, New England Ship-

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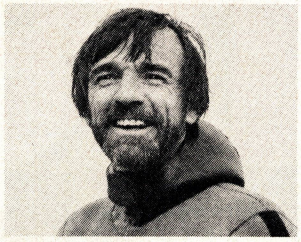
wrecks, Marine Careers, Underwater Filming, Slide Presentations, Marine Contracting and other subjects.

The program will begin at 10:00 am and run until 4:00 pm with a lunch break. The price of an all day admission ticket will be $2.50. The money will go toward the advancement of diving at the academy.

Please contact program chairman Walter J. Westphal, (617) 354-8266, for further information.

TEAM LEADER

Lou Fead has been named instruction team leader at the Underwater Explorers Society (UNEXSO) in Freeport, Grand Bahama Island.



Fead is a director of the National Association of Underwater Instructors (NAUI) and a partner in Waterlou Enterprises, a manufacturer of specialty dive accessories. He began scuba diving in 1966 and was certified as an instructor in 1969. Lou has been teaching recreational diving as a vocation since then, primarily in California, the Virgin Islands and Florida.

NATIONAL U/W PHOTO COURSES

Emphasis on making a living in U/W photography is the new thrust in this year's PADI sponsored seminars on advanced underwater picture taking and instruction. The two day sessions are being offered across the country, taught by professional photo instructor Dick Jacoby.

Five hours of the 24 hour curriculum cover marketing resources, budgeting, pricing guides, sales methods, a system approach to equipment sales, insurance, course development, and how to close a sale. Seven of 19 course handouts emphasize these money-making subjects.

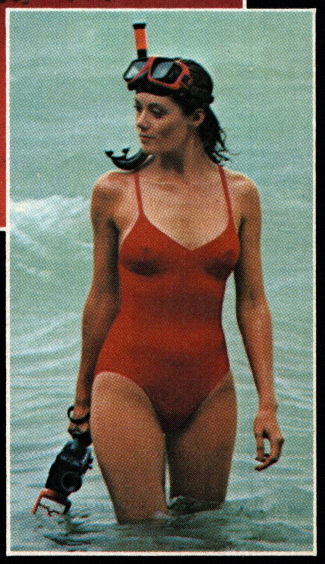
Also new to the seminars is one and one-half hours covering how to repair equipment in the field. Repair of a Nikonos, lens, and strobes is demonstrated, and the session is supported by an eight page handout. Where to go for anything in underwater photo equipment and repair is also detailed.

Remaining courses are May 6 & 7, Chicago, IL; June 6 & 7, Toronto, Canada; July 11 & 12, Miami, FL; September 26 & 27, Denver, CO; October 17 & 18; Atlanta, GA; November 14 & 15, St. Louis, MO. For information, write: Dick Jacoby, 4915 Pershing Road, Downers Grove, IL 60515; or phone (312) 969-0997.

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ikelite

Small Indiana Manufacturer produces world's largest supply of U/W housings and photo accessories

Text and Photography by Rick Frehsee

In the spring of 1963, the company called Ikelite had a rather unceremonious beginning: It unveiled a single product, a plastic handlight for divers. Soon Ike Brigham, a Mid-West dive shop owner with a background in engineering and a penchant for problem solving, was hand-casting three Ikelites a day. Next came a compass with a rotating bezel, then an accessory case and, within a couple of years, a molded plastic housing for the celebrated Nikon F SLR camera. Today, as a result of a product line which has grown to a couple hundred items, an earned reputation for customer service, and one of the most sophisticated computers in the dive business, Ikelite has become the little giant of the general underwater photography market.

This success has been almost unnoticed, partly because of the company's preference for a low profile and partly because it has taken place in a comparatively small industry.

Recently, however, a quiet sophistication has taken place. New, eye-catching products have been developed that promise to satisfy both professional and amateur needs. These have been accompanied by a greater interest in education and information services. We were anxious to learn more about Ikelite's leaders and wanted to get their thoughts on the present and future of underwater photography.

We started with a tour of the Ikelite plant and warehouse located on the same city block where it all began — next to the parent diver supply store in Indianapolis, Indiana. As we were to find out, this Mid-West location, far from coastal diving areas, is not viewed as a significant handicap by management. Inside, the emphasis is on function rather than form. The assembly plant, warehouse, parts department and shipping areas are as straight forward and unpretentious as the company they serve. We got a close-up look at the assembly of the latest version of the popular SLR housing and an inspection of the workings of the new Substrobe 150 electronic flash, two of the most professional products in the Ikelite lineup.

Next, we met several key employees including Larry Ostendorf. The company's electrical engineer, and vice-president, is Tom Kepler, who helped Ike cast the original handlight. This was a regular workday and we had the opportunity to view and photograph normal activity without having to stage any of the product assembly. Working at Ikelite is, of course, not all fun but a spirit of cooperation and a family atmosphere prevails from assembly people to secretaries to management. The company people project a pride and respect for their products and an appreciation of their customers' needs and desires.



Gale Livers



Careful assembly of Ikelite Substrobe 150.

There is even a touch of a "Santa's workshop" feeling here with employees sensing that more than a few of Ike's products are sophisticated toys for adults.

The interview was to start with key questions directed to Ike Brigham and then shift to a general discussion with Gale Livers, the person who has become the public relations figure at Ikelite. Getting to know Ike was a challenging and interesting assignment. He does not generally enjoy the public relations role. We found him at his drawing board, sketching accessories for the latest edition of the Nikonos camera. He politely declined to be photographed and encouraged us to direct most of our questions elsewhere. Although Ike prefers to remain anonymous he is a genuinely handsome man who is as direct and opinionated in conversation as he is articulate and knowledgeable about his subject.

Gale Livers is Ike's opposite, a clue perhaps as to why they function so well together. Gale is a sensitive, creative, ex-architect who has been with Ikelite for nine years. Gale and his wife, Sylvia, who also works at Ikelite, met Ike and his wife as members of the same dive club. At Ike's suggestion, Gale, "showed up one morning at 9:00 am," and has been with him ever since. Gale says he was not a very good underwater photographer at the time, but that has greatly changed since. Today, his responsibilities include the product and underwater photography for Ikelite catalogues and advertisements and the

development of slide presentations for programs such as the annual Our World — Underwater in Chicago. His boyish good looks and genuine enthusiasm for creative underwater photography naturally lend themselves to a public relations role.

It was refreshing being with the Ikelite family if only for a day. Here is a little company of 40 employees with great spirit and sense of purpose — a business which reflects all the best parts of the American free enterprise system and one of the great successes in our industry. During the interview we managed to get a few pearls of wisdom from Gale Livers and even pried loose a couple of gems from the enigmatic Ike Brigham.

SDM: How did you get involved in making products for underwater photographers?

BRIGHAM: We had been making the handlight and a few other items for some time. If it hadn't been for the light, we wouldn't have had the money to spend on photographic products. At the time, there wasn't enough demand to make it profitable. The sales on the light still provides us with the freedom to experiment with new products. As for motivation, I never liked the idea of a plastic box glued together for an underwater housing, and that was all that was available at an affordable price.

SDM: And that's when you turned to injection molded plastics?

BRIGHAM: Right. People have a general misconception about the word plastic, which seems to suggest something brittle. Our housings are made of Lexan — a clear polycarbonate with a very impressive strength to weight ratio. Now combine that with the double sealing Quad-x O-rings we feature on all our fittings, and stainless steel spring snaps on our lids, and you have a housing that is practically indestructible. We have actually taken several models of the current SLR housing to 500 feet in our test chamber before they imploded.

SDM: Do you mean that you guarantee the housing against flooding?

BRIGHAM: We do if it's our fault. And that is easier to determine than you might think. When the suspect housing is left overnight in a bucket of water in a chamber at 200 feet and the inside is bone dry the next morning, it's hard to believe that it was our fault. Nothing is perfect though. As hard as we try there are still a few defects that get out. Out of tens of thousands of seals we've had virtually no failures. In those cases we have replaced the housings and the cameras with no questions.

SDM: What are some of the reasons for Ikelite's success?

BRIGHAM: First, we think small. We practice low overhead and low burden. Second, we build equipment for the average diver, although much of our equipment will satisfy professional demands. Third, we stand behind our products 100 percent with replacement or repair that exceeds anything in writing. Fourth, we are the most computerized business in the dive industry.

SDM: It sounds as if you enjoy your work.

BRIGHAM: There is a lot of fun in a little company from the day-by-day nuts and bolts to the development of a new product. I get a tremendous kick out of people knowing and using Ikelite products. We help keep divers wet by offering alternatives to just diving. It is an artistic and creative environment and once you've taken good photographs underwater, diving becomes a means to that end.

SDM: Gale, what are your responsibilities at Ikelite?

LIVERS: We are small enough so that we all wear a lot of different hats. I do some initial design work, at least in the conceptual stage. I do a lot of product testing, photograph and design our catalogue, and plan our advertising. I have done some in-house teaching and do slide presentations on the outside. We are planning a series of small books on underwater photography, specific to our product line, that I will be putting together.

SDM: Is there anything that you would like to say that makes Ikelite different or innovative?

LIVERS: Ikelite allows people — let's call them novice photographers — to at least sample underwater photography without taking a major step financially. I think that we have more in our product line to appeal to the very new photographer than anybody else. At the same time, Ikelite offers some of the most sophisticated equipment to satisfy the needs of both the amateur and the professional U/W photographer.

SDM: You have a reputation of being very aware of your consumers and sympathetic to their needs. Any comment?

LIVERS: Yes we are, but isn't everyone? Well, perhaps it is because of our location. We have to spend so much money and travel so far to get to good water that maybe it's a little easier for us to relate to people who have to do the same thing. For some it's a matter of just jumping in the car and driving to the beach. Well, it's not quite that easy for us and thus we are a little more aware of what some people must go through to get to nice warm water.

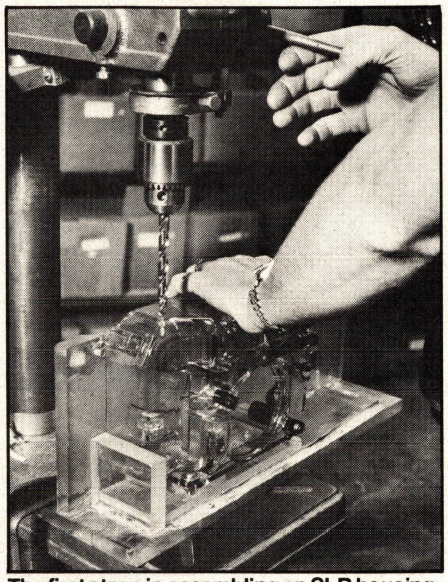
SDM: Since you are so far away from the ocean how do you test your products?

LIVERS: I think we probably have more down time in a swimming pool than anyone else in the industry. We can do almost everything we need to do relative to optics or angle of coverage in a pool. We spent over a year and a half testing several different reflector designs before we brought our new strobe on the market. We also make several trips a year to the tropics and are working on a testing and evaluating center where many of our products will remain in service year-round.

SDM: Are there any new products on the way that you would like to mention without giving away any secrets?

LIVERS: Well, we're not real secretive about new products. We are very pleased with our Substrobe 150 electronic flash, and this year we will have a smaller strobe on the same order. It will have a guide number of about 40 with ASA 25 film. It will use either disposable or rechargeable batteries. There will be a new, smaller arm system to go with it — an extremely flexible little arm that people will enjoy using. And, of course,

(Continued on Page 94)



The first stage in assembling an SLR housing.



Custom controls and fittings being added.

Technifacts



In a previous Technifacts a commercial diver was defined as one who gets paid for performing some function underwater. By this definition a dive shop operator is not necessarily a commercial diver since he performs services above water. However, many dive shop operators have available most of the dive equipment needed to peform commercial diving functions. Additionally, the shop usually has personnel and boats suitable for at least some types of commercial diving. A few shops do perform underwater work with some success. Others attempt jobs with almost no success at all.

This and the next few Technifacts will be designed to help dive shop owners and other divers put their equipment and expertise to remunerative use.

Usually a dive shop is located in an area close to enough water to permit boating. Where there is boating there are usually anchorages and moorings. It is where these exist that the diver will find opportunities for some commercial diving. Jobs for the diver will include: search and recovery; anchorage and mooring inspection, maintenance and repair; boat inspection, hull cleaning, maintenance and repair, including installation and replacement of corrosion control devices; small boat salvage including measuring and fitting small patches; and occasionally work in connection with law enforcement officers.

ANCHORAGES AND MOORINGS

An anchorage is defined as a place where vessels anchor; or a place suitable for anchoring. A mooring, on the other hand, is a place where a vessel can be made fast, such as to pilings or a pier. However, a vessel can be moored while in an anchorage if it is tied up to a buoy which is anchored. Or it is moored if the boat drops two or more anchors to hold it more or less in one place, such as a two or three point moor using two or more anchors.

In the latter case there seldom is work for a diver unless the boat's anchors become fouled in such a manner that the boat operator cannot get them free.

Moorings that consist of a buoy made fast to some form of anchor to which boats may tie up do sometimes require the services of a diver both in the initial installation and for infrequent inspection and repair. Such moorings use buoys, chains, shackles and some form of weight to serve as an anchor. Divers are sometimes used to put the various components together underwater, although it would be more economical to put the pieces together topside, float them to the mooring site on a suitable barge or large boat, and then place them as required.

When divers are used for this work, and for any future diver inspection of such buoy-chain-anchor type moorings, the diver should pay special attention to the extent of wear in any parts of the system, particularly the dip section of chains and the shackles. Also, all shackles should be safety shackles properly secured by cotter pins or, if screw pin shackles are used, with safety wires.

If a mooring system is rented to boat owners it is imperative, for liability reasons, that the system hold the boat safe and secure in any type weather. Inspections must be thorough, complete and careful. Written reports of any findings, even though the system is in all respects normal, should be submitted to the operator of the mooring.

Moorings involving floats or piers to which boats are tied may use pilings or anchors and chains to hold the floats in place. Divers are seldom used in the construction of a mooring using pilings to hold the piers or floats. Following construction divers are only occasionally used and then mostly to make inspections of units that fail, such as a broken piling or support for the piers, sunken floats, or occasionally to inspect a sunken boat in a slip.

In reviewing work done by divers for a local mooring having over 800 boats at various slips and piers, it was found that underwater inspection or work was required about twice each year for a total of seven working days annually. One incident involved a piling that broke off and struck a boat causing extensive damage. The diver was able to verify, through inspection and underwater photos, that the piling had been damaged during the construction phase and not as a result of anything the moored boat did to it. This was an important finding owing to the amount of money involved in law suits. Other work in this mooring involved clearing slips of sunken debris, recovery of lost mooring property and inspection of boats to determine cause of hull damage that resulted in sinkings. In addition to the work for the owners of the marina, approximately 60 diving days were contracted for by boat owners for a wide variety of jobs.

In coastal areas of the world there will be dozens of similar marinas (small boat anchorages and moorings) within a local diver's working range. Around large lakes, there may be several marinas. This concentration of small boating activities can mean jobs for the enterprising commercial diver, either for the marina operator or for the many boat owners.

SMALL BOAT INSPECTION

A small boat, as the term is used here, is one too large for trailering but less than 100 feet long. Obviously there would be practically no inspection, maintenance or repair work for a diver in connection with a boat that can be hauled out of the water via a trailer. However, underwater salvage of such boats is sometimes required.

An inspection of the underwater part of a small boat serves two important functions. First, it will enable a report to be made to the owner or operator of the boat regarding the extent of any damage or irregularities that may exist in the hull or fittings of the boat. Secondly, and this may be just as important, an inspection will determine that the boat is in all respects normal and ready for use. The latter information makes it possible for the owner to plan and operate the boat in a safe manner. In either case an underwater inspection of a boat by a diver must be complete, thorough and accurate.

(Continued on Page 98)

scuba Quiz

Category: Underwater Strobes

By Dennis Graver

Strobes have become very popular for underwater photography, but they can be a source of frustration unless you understand some basic principles of theory and use. Find out what you know (or don't know) about underwater strobes and their use with this month's quiz. The answers are on the next page.

1. When a conventional strobe is placed in a flat port housing for underwater use, the strobe's beam angle will be:

- ☐ A. The same as it is in air
- ☐ B. 25% wider than it is in air
- ☐ C. 25% narrower than it is in air
- ☐ D. 50% narrower than it is in air

2. Select the preferred color temperature for light emitted by a strobe:

- ☐ A. 5000 degrees Kelvin
- ☐ B. 5500 degrees Kelvin
- ☐ C. 6000 degrees Kelvin
- ☐ D. 7500 degrees Kelvin

3. The fastest shutter speed at which the typical focal plane shutter camera will synchronize with an electronic flash unit is:

- ☐ A. 1/30 of a second (1/50 on some cameras)
- ☐ B. 1/60 of a second (1/90 on some cameras)
- ☐ C. 1/250 of a second
- ☐ D. 1/500 of a second

4. A strobe reaches full power capacity:

- ☐ A. As soon as the ready light comes on
- ☐ B. Five seconds after the ready light comes on
- ☐ C. About the same length of time after the ready light comes on as it took it to recycle
- ☐ D. Only when the ready light comes on and starts blinking

5. Which of the following statements is true concerning batteries used in strobes:

- ☐ A. Low temperatures prolong battery life
- ☐ B. High temperatures can prevent a battery from holding or taking a charge
- ☐ C. Temperature ranges of 30-150 degrees F have little effect on modern batteries
- ☐ D. A and B are correct, but not C

6. Which type of battery is most likely to cause overheating of strobe electronics:

- ☐ A. Carbon-zinc
- ☐ B. Alkaline
- ☐ C. Ni-cad
- ☐ D. No difference

7. With a variable power strobe set at one-half power, the beam intensity will require an aperture setting that is:

- ☐ A. One f stop more than that required for the full power setting of the strobe
- ☐ B. One f stop less
- ☐ C. Two f stops more
- ☐ D. Two f stops less

8. Changes in exposure are greatest when a strobe is moved from a distance of:

- ☐ A. Two feet to four feet
- ☐ B. Three feet to five feet
- ☐ C. Five feet to eight feet
- ☐ D. Ten feet to 15 feet

9. When aiming a strobe at a subject underwater, the strobe should be aimed:

- ☐ A. One third of the strobe-to-subject distance in front of the subject
- ☐ B. Directly at the subject for the apparent strobe-to-subject distance
- ☐ C. One third of the strobe-to-subject distance beyond the subject

10. To obtain optimum power from ni-cad batteries, it is best to:

- ☐ A. Completely discharge and fully recharge the batteries
- ☐ B. Partially discharge and fully recharge the batteries
- ☐ C. Minimally discharge, but fully recharge the batteries
- ☐ D. Leave the batteries completely discharged until just before use, then fully charge them

Scuba Quiz

Answers: Underwater Strobes

1. C. 25% narrower than it is in air. Light refracts (bends) as it passes through mediums of different densities. This refraction will cause the beam angle of a housed strobe to be only about three-quarters of the beam angle in air. Beam widener attachments should be used when dome ports are not a feature of a strobe.

2. B. 5500 degrees Kelvin. Most films are balanced for exposure with a 5500 degree light source. The higher the light temperature the bluer the light, and the lower the light temperature the redder the light. Strobes with a high color temperature tend to render bluish skin tones at close range.

3. B. 1/60 of a second. The shutter curtains move mechanically and slowly compared to the brief burst of light emitted from a strobe. In order to sync, the shutter must completely uncover the film at the time the strobe fires. Few focal plane shutter cameras can accomplish this at shutter speeds above 1/60, although some can sync at 1/90.

4. C. About the same length of time after the ready light comes on as it took it to recycle. Short recycle times are desirable, so sometimes ready lights are connected so they turn on before the storage capacitor reaches full charge. As a rule of thumb, wait twice the recycle time of the strobe to assure full power.

5. D. A and B are correct, but not C. High temperatures (95°+) and humidity cause energy deterioration in batteries. Try to store them in a cool, dry location. Keep photo equipment out of the sun and avoid storing it in the trunk of a car or in other hot places. Voltage loss can be reduced by storing batteries in a refrigerator, but keep them dry and allow them to warm up to room temperature before use.

6. C. Ni-cad. During use, the voltage of a battery is less than its rated voltage. However, the voltage drop of a ni-cad battery is less than that of other batteries. This results in greater currents during strobe recycling and can generate heat that can cause damage. Be sure to check the manufacturer's instructions before using ni-cad batteries in your strobe.

7. A. One f stop more than that required for the full power setting of the strobe. The amount of electrical energy stored in a strobe prior to flashing must be doubled in order to double the light output of the strobe. Since each decreasing aperture setting of the lens doubles the amount of light reaching the film, opening the aperture one stop will allow the correct exposure with only half of the strobe's capability utilized.

8. A. Two feet to four feet. Light intensity varies inversely as the square of the distance from the light source. There is only one fourth the light at a distance of four feet from a strobe as there is at a distance of two feet from the strobe. The closer the light source to a subject (proximity is typical for underwater use), the more critical the control of the light intensity becomes.

9. C. One third of the strobe-to-subject distance beyond the subject. Because objects appear larger and closer underwater, we tend to aim strobes at the apparent position of a subject rather than at the subject's actual position. To correct for this parallax, aim beyond the apparent position by the degree of magnification created by refraction of light underwater.

10. A. Completely discharge and fully recharge the batteries. Unused ni-cads tend to be weak as do those used at less than full capacity. To obtain full capability from the batteries, discharge them until strobe recycle time reaches 30 seconds, then fully recharge the batteries. When used infrequently, several discharges and recharges are recommended before the batteries are used for photography.

A score of 8-10 correct answers is excellent. Five to seven is average. Those missing more than five should definitely have been illuminated by the information in this quiz. Those with low scores would have done well, however, if they could have bracketed their answers . . . of if they had participated in an underwater photography specialty course!

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WATTS

Frame Your Fish For Fabulous Fotos

Get Your Subjects to Swim Through Hoops

Text and Photography by Geri Murphy

Have you ever wondered how the pro's get super sharp photos of beautifully colored fish? The basic key to their success is to get in close so that the fish image fills the picture frame, providing crisp detail of even the tiniest scale pattern, fin structure or eye coloration. Image size is equally important as sharp focus, and that is where the close-up lens makes the difference.

Have you ever wondered how underwater photographers can coax one of those skittish fish into the close confines of a wire framer? The first time you try it, it may seem impossible. Until you learn the secrets of fish behavior it won't be easy.

Have you ever wondered why fish portraits (such as SDM's Fish of the Month) seem to burst into sharp, vivid colors while your own attempts may be a drab, blue-gray? Getting close to the fish subject (less than one foot) via the close-up lens reduces the blue filtering effect, resulting in rich color saturation.

If you are interested in taking sharp, brilliantly colored fish pictures and want to learn how, read on. Discover the world of the close-up lens and see how it can produce pictures that will amaze and delight you and your friends.

THE EQUIPMENT

The Nikonos Close-Up Outfit made by Nikon is the highest quality close-up system available. It consists of a close-up lens, support rod, framer support arm and three framers for use with the 28mm, 35mm, and 80mm Nikonos lenses. This versatile kit has a wide range of possibilities and a good deal more lens compatibility than any other close-up lens presently on the market. It can be used U/W with any of the three Nikonos lenses and it can be used in air with the 35mm and 80mm lenses. The system can be assembled or disassembled underwater as well as on the surface. Best of all, I have found that the Nikonos close-up lens consistently produces fine quality photos.

A GLASS LENS

The Nikonos close-up lens is a two element, two group precision ground glass lens, designed to match the optics of the primary Nikonos lenses. The glass elements are mounted in a heavy-duty, anodized aluminum collar that fits over the primary Nikonos lens. It is held in place at the top with a small support rod which slips into the camera's shoe mount. An adjustment knob on the underside of the mount is used to tighten an internal metal band that encircles and grips the primary Nikonos lens. When using the unit underwater, the area between the close-up lens and primary lens must be flooded. Nikon has provided a slot at the top and bottom of the body to allow water to flow through and air to escape. If bubbles or sand become lodged on the inside, the close-up lens can be removed underwater and quickly cleaned.

FRAMER SUPPORT ARM

The framer support arm is an aluminum rod which slides into a mount found at the base of the close-up lens. A fastening knob on the support arm holds the rod securely in place. The support arm is used to hold the wire framer at the correct distance from the lens for sharp focus and proper framing.

FRAMER

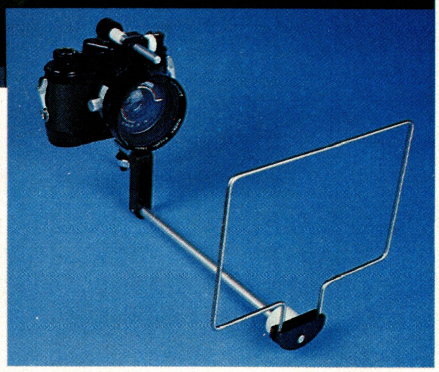
The Nikonos close-up lens uses a four-sided wire framer for optimum ease in picture composition. This is made of heavy gauge stainless steel wire which will not bend easily, yet is flexible enough to give under extreme pressure. The open ends of the framer are inserted into holes in the support arm and the locking collar is tightened to secure them.

The framer is the only component in assembly that changes according to your choice of lens. The Nikonos close-up kit includes three different framers that match up with the Nikonos primary lenses — 28mm, 35mm and 80mm. Each framer is permanently engraved with the corresponding correct camera lens when used underwater. Above water, the 28mm framer is used with the 35mm lens and the 35mm framer is used with the 80mm lens. The 28mm lens is not used.

Regardless of lens selection, the framer will be nine and one-quarter inches from the outer surface of the close-up lens when assembled. This distance is the point of focus when the primary lens is set for infinity. If the distance is set at less than infinity, the plane of focus is not at the framer edge, but closer. All of the framers are slightly oversized to ensure that they will not appear in the picture. The imaginary border inside the four sides of the framer is about



photo/Paul Tzimoulis



Above, the author demonstrates the proper technique (using bait) to attract a jack into the wire framer. Right, the Nikonos Close-Up Outfit, showing the camera, lens, framer support arm and wire framer. Opposite, the grouper is revealed in breath-taking color and detail in this close-up.

three-eights inch, measured from the inside edge of the wire.

DEPTH OF FIELD

To attain maximum depth of field, the aperture should be set at f22. Anything larger than f22 will greatly reduce the margin of sharp focus. At best, a photographer using a 28mm lens set at f22 will have a depth of field of approximately three inches. From there, it is downhill. A powerful strobe and an aperture setting of f22 are two of the secrets of sharp fish photos. The mini-chart below refers to the Nikonos close-up lens when used underwater and the distance scale is set at infinity.

Lens	Subject Area	Magnification	Depth Of Field
28mm	5 5/8 x 8 1/2	1:6	3.1"
35mm	4 1/4 x 6 1/3	1:4.5	1.9"
80mm	2 1/16 x 3 1/8	1:2.2	.4"

All measurements are in approximate inches. Depth of field based on camera setting at f22. A much more complete



depth of field chart for all f stop settings is included with each close-up kit purchased.

TECHNIQUE

Armed with camera, close-up lens, powerful strobe and lots of enthusiasm, the photographer is now faced with the challenge of getting the fish to fill the frame. At first, it may seem as difficult a task as trying to teach a lion to jump through a hoop. Maybe not as dangerous, but just as impossible — or so it seems. But before I discuss hoop tricks, let's start with the basics.

SELECTING A SITE

Photographers who specialize in fish portraits will usually select a reef where fish are plentiful and friendly. They may know the area from previous dive trips or from asking the divemaster specific questions about the marine life. In any event, it is best to learn as much as possible about the reef you are going to use for fish photography.

Stay away from reefs with surge or current. You need to be steady and in complete control for successful framer photography. Under adverse conditions the fish are more skittish and the photographer becomes frustrated. Pick an area where you can settle down and work in one place. If there is too much surge, perhaps you can move to deeper water where conditions are calmer.

DIVE SKILLS

A successful underwater photographer must first be a good diver. Flailing arms and legs and thrashing fins will assuredly discourage any fish from coming close to the camera. Divers should be properly weighted. An overweighted diver runs into a reef like a 747 jet crashing into a mountain. Breaking coral all around him, he is oblivious to the trail of destruction he leaves as he struggles to his fins to attempt lift-off. Stirring up a mushrooming cloud of sand, he triumphantly swims toward another landing site, leaving a choking, blinding sandstorm in his wake. After the dive and back on board the boat the same diver complains that he did not see many fish on the reef.

The basic concept of using a close-up lens with a wire framer for fish photography is to get the creature to come to you. Bounding into the water and smashing into the coral like a wrecking ball will frighten the local residents into hiding. The road to success starts with the photographer quietly and calmly establishing himself/herself in position on the bottom. Look at it from the fish's point-of-view: A huge, strange and loud alien just landed in its back yard. Naturally it would rather not have intruders sitting on its doorstep, but if it does not feel threatened, its curiousity will eventually bring it back out to look you over. You need a lot of patience, but if you are quiet the fish will get accustomed to your presence.

FEEDING THE FISH

While by nature most fish are curious enough to approach the calm, non-destructive diver, there is a faster, more reliable method to get the fish to come through your framer. Food! It is the basic form of payment, fundamental in any language. Most fish have a natural fear of the wire framer and will not pass through this squarish hoop under normal circumstances. However, a craving for food will usually overcome this fear.

Start by placing food outside the framer, a foot or so away from the camera. Use only a few small morsels. As the fish gains confidence, bring the food closer until you are dropping bits of food squarely in the center of the frame. With the proper timing, you can snap the shutter just as the fish swallows the bait.

Not all subjects need to be coaxed to the wire framer. Close-ups of less mobile animals can be simpler and just as exciting. This seahorse at the Frederiksted Pier, St. Croix provides a perfect example. The photographer can take the time to choose his background.

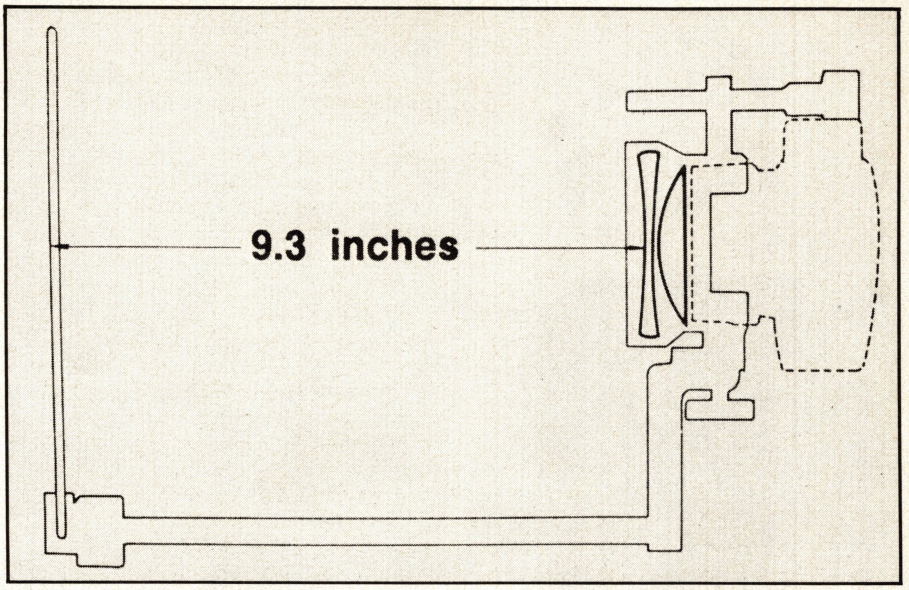


CHOICE OF FISH FOOD

The choice of fish food is critical to your photographic success. If it is the wrong type of food, the fish will simply ignore it. If it is messy, the food will cloud the visibility and ruin the picture.

Choose a food your fish are known to like. Different fish have distinctive diets. For example, groupers love conch but ignore chopped sea urchin. On the other hand, moray eels prefer fish fillets and will not eat conch. It is important for you to learn the feeding habits of the fish that you want to photograph. You can do this by asking the local dive guide or by observing the fish first hand and testing two or three different kinds of food.

Select a food that does not disintegrate easily in water. Bread crumbs and crackers are terrible — they dissolve and create murky clouds of milky water. I once tried to feed fish with a can of sardines packed in oil. I thought the oily smell would attract more fish. Instead, the oil not only got on my hands, making everything I touched slippery, but coated my lens as well! I found conch to be an ideal fish food because it holds together regardless of time immersed in water. Frozen fish fillets, such as ballyhoo or mullet, are also my favorites but are more expensive.



With the Nikonos Close-Up Lens in place, subject distance is 9.3 inches (235mm) from the vertex of the lens. The focus must be set for infinity to accommodate the system.

FOR YOUR PROTECTION

Fish feeding and photography go hand in hand but both are skills which need practice. Do not start out by feeding a giant ten foot moray eel. Even feeding small groupers can be hazardous, so proceed with caution.

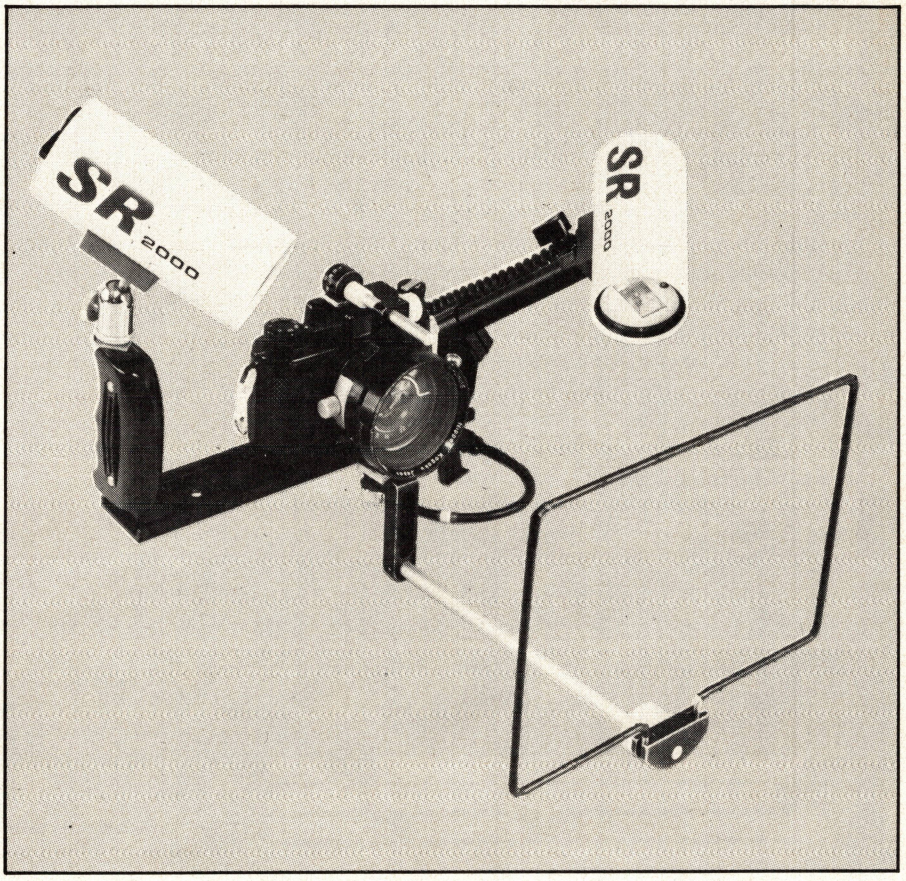
First of all, store your food in a covered container such as a coffee can or plastic bottle, so your fish cannot see the snack until you want it to. Do not use clear plastic bags. The fish will try to snatch the bag and these unsuccessful attempts will just excite and frustrate it, causing attacks on the bag and you.

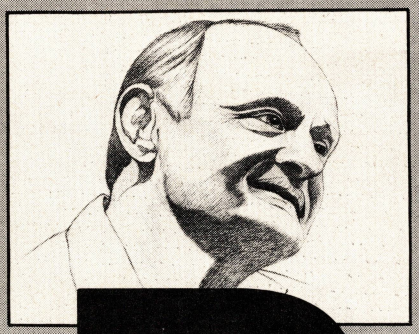
Fish feeding involves a certain degree of risk. If you fish feed on a regular basis, you will probably be bitten some time. Wearing gloves is the better part of valor and eliminates the distracting concern of counting your fingers while trying to get a photograph. The ideal method, however, is for your buddy to be dropping the food in front of the framer while you devote your entire attention to shooting the picture.

If all else fails and the fish still will not approach the framer, simply remove the framer! With the support arm still in place, you can still have an accurate way of measuring the 9¼ inches for focusing. With a little practice you will be able to determine the approximate framing area. I know one photographer who will even take the support arm off and estimate the focus distance rather than lose a shot of a lobster tucked deep within the recesses of the coral reef. This takes a little more skill however, because even an inch will throw the picture out of focus.

Close-ups provide some of the most productive and rewarding underwater photographs. Focus, aperture and shutter speed are preset before the dive and do not change. These factors give beginners the good feelings of instant success. Discover a new dimension of the underwater world with close-up fish photography. You'll be glad you did.

Close-up photography requires an artificial light source. In this case, two strobes (one a cordless slave) are used. The strobes are aimed to illuminate the area inside the framer.





Rx FOR DIVERS

BY CHARLES V. BROWN, M.D.

MORE ABOUT BUDDIES

This comment is motivated by the recent tiff over the buddy system. We'll define the buddy system as two divers keeping tabs on each other, not just entering and maybe exiting the water together. We're for it, sort of, up to a point. Still, we think back. In years gone by, many of us dived without buddy, depth gauge, watch, submersible tank pressure gauge, compass, or even a workable buoyancy device. Being fearful, we started gingerly and progressed gradually. With experience we learned to judge quite closely the data that today's divers are accustomed to reading off dials.

Without a buddy, we studied the dive conditions more carefully, opted against hazards, and were alert and self-reliant. There was no competitive nudge to tempt us to take chances or over-extend ourselves, and of course there was no danger that the non-existent buddy would draw us into hazardous situations.

The buddy system is neither sacred nor silly. In some diving situations it may be more bother than it's worth, while in others, the security it provides more than justifies any nuisance. The old pro knows when it's nice to have someone around to bail him out, just in case. The diver with more macho than experience rejects a buddy at his peril.

The worst mockery of the buddy system occurs when two newly certified divers team up. In an emergency, neither is qualified to help himself, much less his buddy. Tragedies confirm this year after year. So select a buddy with circumspection.

To share the joy of diving and ensure mutual security, it's wise to buddy up. Sometimes. All right, most of the time.

Question: A commercial diver writes from Nova Scotia to inquire about the connection between dehydration and decompression sickness. He's been advised to drink plenty of liquids. Does it really matter?

Answer: Diving, and especially prolonged dives such as commercial work shifts, tend to dehydrate the diver. This is partly because the dryness of the breathing gas results in increased evaporation of water from the lungs, but mostly because diver's diuresis produces a large volume of urine. It's generally agreed that dehydration favors decompression sickness and good hydration is protective.

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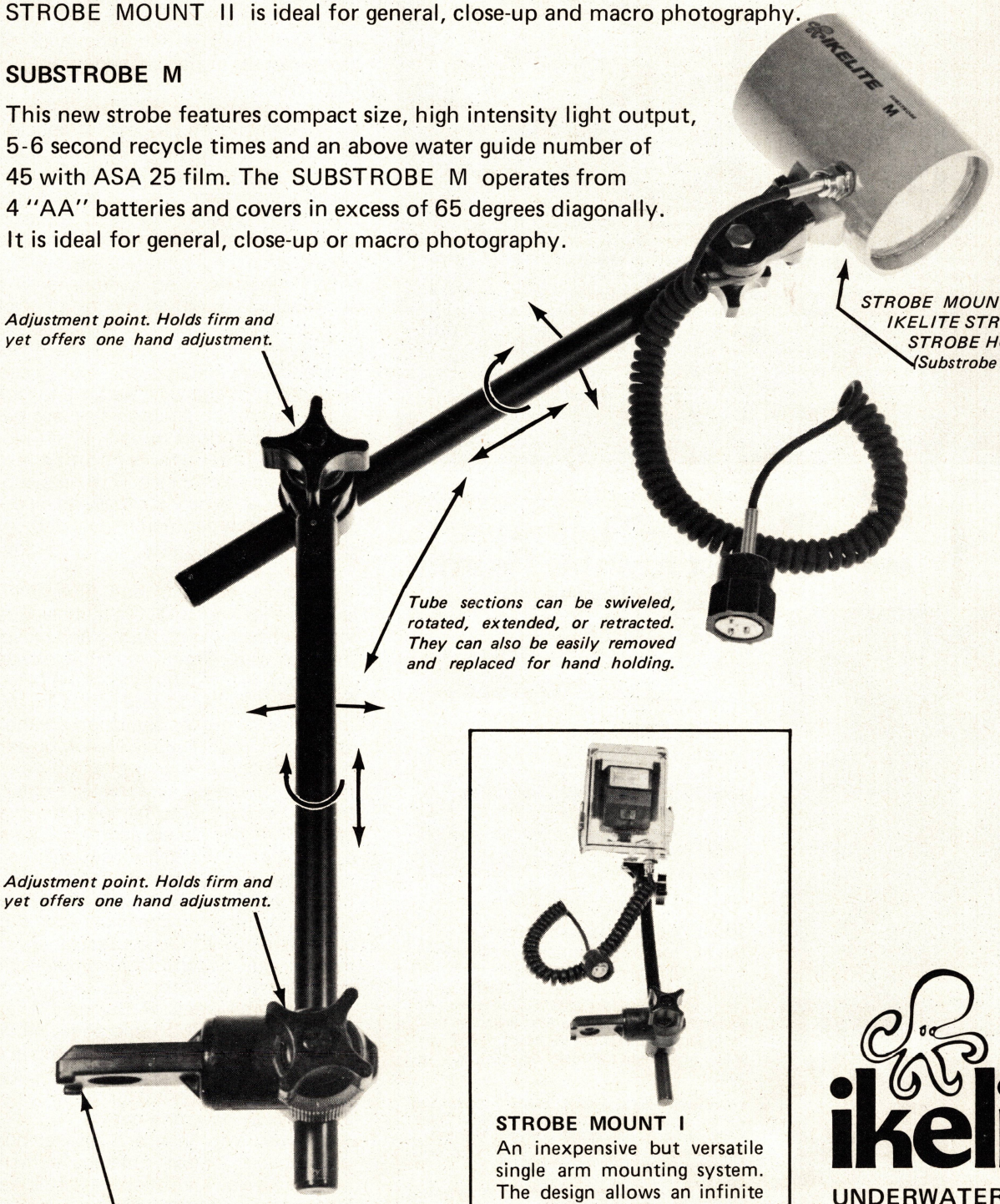
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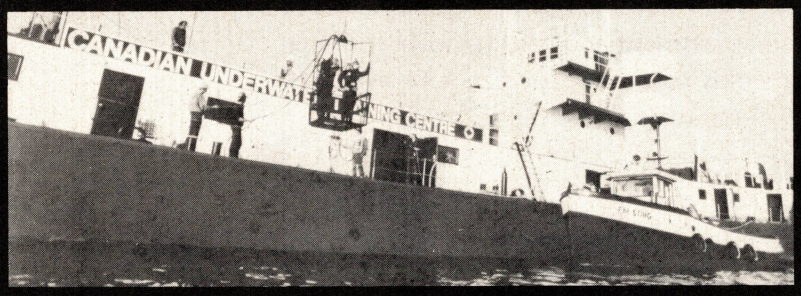
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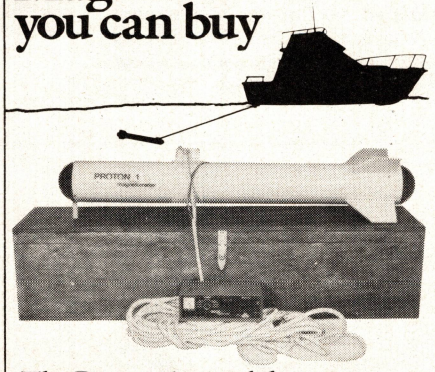
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RX FOR DIVERS

The reason is not well understood, but we do have some ideas.

Urine is essentially an ultrafiltrate of arterial blood, which is equilibrated with alveolar gas tensions. Its nitrogen tension should be close to that of the breathing gas. Therefore, urine passed during a dive carries more nitrogen out of the body than is carried in by the replacement water you drink afterward. Water imbibed after surfacing dilutes your nitrogen load. However, the importance of this factor is miniscule and probably negligible.

What may be more important is the effect of dehydration on gas micronuclei. Micronuclei are very tiny, harmless bubbles that tend to grow to harmful size during decompression. Surface tension opposes their growth. The blood contains surfactants that reduce surface tension. Dehydration concentrates the surfactants, further reducing surface tension and making it easier for the micronuclei to grow.

Probably most important is the effect of blood concentration on clotting and circulation. To see why, we have to look at the way decompression sickness develops. Most dives apparently do produce bubbles. We recognize decompression sickness only when symptoms appear, but there's really no rational dividing line between normal and decompression sickness — it's a continuum.

Reactions at the blood-bubble interface release highly active substances that favor both blood clotting and movement of water from blood into tissue spaces. This concentrating of the blood further favors clotting, and brings the red blood cells closer together so they sludge and resist flowing. Now if you add the blood concentrating effect of dehydration, you make it all worse. The defective circulation greatly hampers removal of gas from the tissues and encourages bubbling anywhere in the body. You can easily move from silent bubbles to overt decompression sickness, or from mild to severe decompression sickness. You also move toward cardiovascular shock that will not respond to recompression treatment alone. So drink up.

Question: Diver D. R. Darling of Tampa, Florida is an EMT (emergency medical technician). He loves both diving and medicine and would like to combine the two. Is there a place for underwater EMT's? How does one get in?

Answer: Yes, there's a distinct and present need for diving medical personnel, particularly in offshore oil fields. Many of the these are or will be in remote areas of the world where conventional medical facilities are beyond easy reach. The only formal training program of which

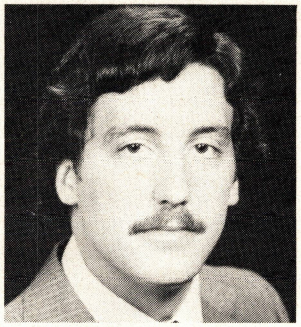
we're aware is offered by the Commercial Diving Center, a subsidiary of Oceaneering International. The program has been in operation for about five years now, and according to Jim Joiner, who heads CDC, the job placement score for graduates has been 100 percent. For information write to Mavis Hill, Admissions Director, CDC, 272 South Fries Ave., Wilmington, CA 90744; or phone (213) 824-2501.

Question: Charles Stanberry of State College, Pennsylvania has had a positive tuberculin skin test since he did a teaching stint in Africa five years ago. Recent X-rays show some scarring in his lung. Should he drop out of his basic diving course?

Answer: It's true that lung scars are considered a potential cause of air trapping and lung rupture. However, the scar of early arrested tuberculosis does not seem to pose much, if any, hazard. Many middle aged and older people with a positive skin test and such a scar have been diving for a lot of years, and we've never heard of a problem attributable to the scar. If your doctor concludes the scar implies nothing more than old tbc exposure, and finds naught else amiss, we think it reasonable to go on with your diving.

AQUA-CRAFT REP

Rick Caballero has been appointed exclusive sales representative for Aqua-Craft products in Florida. A native of Miami, Rick was formerly sales manager for Belcher Industries' Gary Marine Division.



His new duties representing Aqua-Craft will be to give more personalized service to the dealers and keep them abreast of the latest developments in diving accessories.

Rick can be contacted at: 7725 S.W. 86 St. A1-123, Miami, FL 33143; (305) 274-9170 or through Aqua-Craft, 7992 Mirimar Rd., San Diego, CA 92126; (714) 271-7000.

SUBSEA PRODUCTS

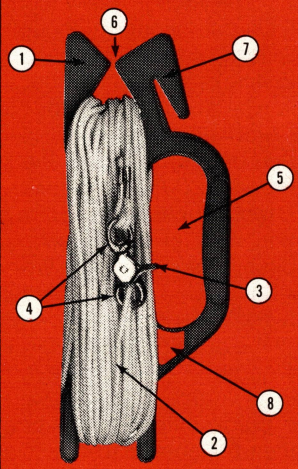
One of the products featured in the New Gear section of the March SDM was Subsea Products' Mark 30 U/W strobe. The correct address of Subsea Products is 1006 West 15th Street, Riviera Beach, FL 33404.

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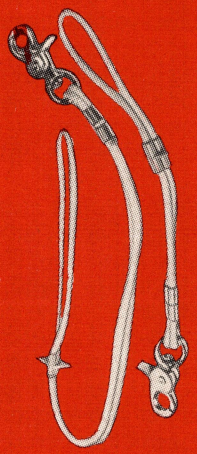
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THE ARCH

gateway to California's Santa Barbara Island

Text and Photography by Rod Anton

One of the top ten dive sites in California is also probably one of the most overlooked. The forgotten island among the Channel Islands, Santa Barbara, lies 38 miles straight out of San Pedro Harbor. A mere one and one-quarter miles in length, she has one of the most beautiful, colorful, surface trademarks of all the Channel Islands. That trademark is the endemic plant, the giant *Coreopsis,* measuring six to eight feet in height. When in bloom during the spring months it carpets the landscape a luxurious golden yellow that can be seen as far away as ten miles. Theory has it the island is a small mountain top, once part of the mainland. Upon geographic isolation from the mainland by water, over 80 plants and several animals evolved into sub-species, different from their mainland relatives and found nowhere else in the world.

The island's physical structure consists of two vertical sea cliffs, each one more than 500 feet high. Santa Barbara Island also has several caves, offshore pillars, and numerous blowholes making for some of the most dramatic seascapes along the entire California coast.

Not to be outdone by surface scenes, the waters of Santa Barbara Island offer one of the most majestic natural structures I have ever dived. Located a few hundred yards off the northeast end of the island is a phenomenon known among the boat captains, crews and divers as the Arch. It is just that, an archway carved into a giant sea cliff. The sand base of the Arch lies 50 feet under water. It is approximately 100 feet wide with the opening rising from the bottom 30 feet upward to the curved top of the archway. The top portion of the structure is approximately 15 feet high and 30 feet thick. At low tide it lies only five feet beneath the surface creating a navigational hazard to the unwary boatman. Usually the surface conditions are such that a boiler appears which helps in locating it. The Arch is easily found on the charts. On one occasion, though, it took Roger Hess, captain of the *Charisma*, over 45 minutes to locate it because the surface was absolutely mirror flat.

The Arch appears in all its majesty when you descend through the kelp forest surrounding it. The visibility usually runs 50 feet or better, giving one an overwhelming view of this awesome structure. Usually, surge is not welcome to divers, but when it occurs on the Arch, it provides a thrilling ride back and forth through the opening. A very large school of surf perch is almost always present, sharing its vertical formation with a number of blacksmith and an occasional sheephead. Santa Barbara Island has one of the larger sea lion rookeries on the West Coast (approximately 500 live there year-round), leaving you open to experience one of the "neat treats" of California diving. Over 70 percent of my dives in this area have been punctuated by the silent buzzing of a California sea lion. These encounters are certainly highlights of my dive career.

Although the Arch is certainly an exciting dive it isn't really the high point of the area (no pun intended). For an unparalleled treat in what I call mountain diving start at the base of the Arch and head toward the northwest to west side. The terrain begins at 50 feet and slopes downward at about a 25 degree to 30 degree angle leveling off near 100 feet. All along this area the kelp grows with outstretched limbs reaching toward the surface, inviting the sun's rays to filter downward through its fronds. Back lit by the sun are great bushes of the bright red fan coral. These large, trellis-shaped fans stand as outcroppings among the huge, room sized boulders that dot the landscape. These formations offer a haven for an endless variety of marine life including an occasional patrolling of the perimeter by a blue shark or two. Many divers feel they can experience all the thrills of the Arch itself in just two or three dives. However, the place I call the Mountain would take far more dives to explore.

You're probably thinking a single place can't possibly contain anything more. But, we're just now getting to the really super spot. It is generally accepted that wall diving is a specific trait of tropical diving. Even then, only in selected locations. Behold, as we start to swim to the seaward side of the Arch another phenomenon occurs: The Arch Wall appears before us. Starting at 25 feet, a plateau drops abruptly over a sheer vertical face, plunging to a sandy bottom at 90 feet. The vertical backside of this wet amphitheater runs along, fence-like, for well over 300 yards, finally curving around and eventually sloping back upward to the plateau. The diver has to stop frequently along this craggy face in order to observe the numerous small creatures that inhabit the many nooks and crannies. The most beautiful of the mini-creatures clinging to their vertical homeland is the dragon-like purple nudibranch *(Flabellina iodinea)*. Not to be outdone by this creature, small in size but large in colors, the great red fan corals once again appear all along the wall, gracefully swaying in the liquid breeze. At the base of the wall there are large crevices that hide pods of lobsters and an occasional horn shark. Of course, not every crevice has lobster. I have seen as many as 25 in one crevice, though.

What you have just read about is merely one dive spot — in my opinion, the best of Santa Barbara Island diving. For those whose tastes in diving diversify into di-

The Arch is located off the northeast end of Santa Barbara Island. The huge opening is nearly 100 feet wide and 30 feet high. The base of the Arch is at about 50 feet.

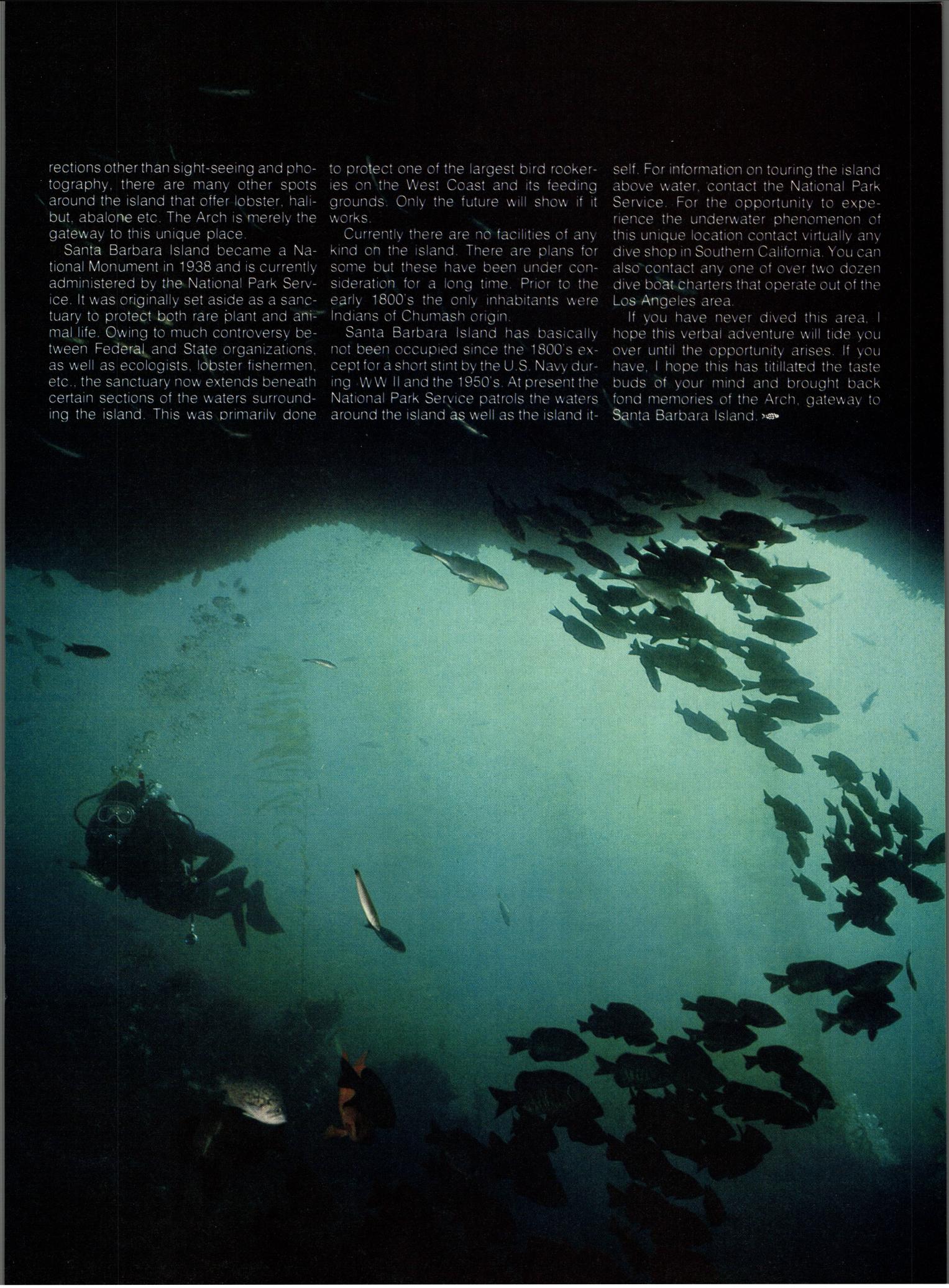
rections other than sight-seeing and photography, there are many other spots around the island that offer lobster, halibut, abalone etc. The Arch is merely the gateway to this unique place.

Santa Barbara Island became a National Monument in 1938 and is currently administered by the National Park Service. It was originally set aside as a sanctuary to protect both rare plant and animal life. Owing to much controversy between Federal and State organizations, as well as ecologists, lobster fishermen, etc., the sanctuary now extends beneath certain sections of the waters surrounding the island. This was primarily done to protect one of the largest bird rookeries on the West Coast and its feeding grounds. Only the future will show if it works.

Currently there are no facilities of any kind on the island. There are plans for some but these have been under consideration for a long time. Prior to the early 1800's the only inhabitants were Indians of Chumash origin.

Santa Barbara Island has basically not been occupied since the 1800's except for a short stint by the U.S. Navy during WW II and the 1950's. At present the National Park Service patrols the waters around the island as well as the island itself. For information on touring the island above water, contact the National Park Service. For the opportunity to experience the underwater phenomenon of this unique location contact virtually any dive shop in Southern California. You can also contact any one of over two dozen dive boat charters that operate out of the Los Angeles area.

If you have never dived this area, I hope this verbal adventure will tide you over until the opportunity arises. If you have, I hope this has titillated the taste buds of your mind and brought back fond memories of the Arch, gateway to Santa Barbara Island.



U.S. DIVERS

25 years of progress in wetsuit design

Text and Photography by Eric Hanauer

Thank goodness, they don't make wetsuits like they used to. My first, a U.S. Divers Nordic, cost $40 back in 1959. It taught me all I ever want to know about hypothermia. Every dive was a test of perseverence which ended not when my bottom time was up, but when those icy fingers of Mid-Western lake water dropped my core temperature into the agony zone.

But the old timers of those days thought our neoprene suits were orders of magnitude better than the latex drysuits they had started with. And, today, I still enjoy telling new divers how I braved the ice of Racine Quarry in a 3/16 inch suit, especially when they complain about cold water in their custom farmer johns. What I don't tell them is that the best part of those dives was the hot buttered rum in the warming hut after we got out.

When SKIN DIVER Magazine asked me to write about the new line of U.S. Divers suits, it was like coming home again. I was curious to see what changes the past 25 years had wrought in their products. My guide was Ed Scott, the company's marketing manager. He has been with the firm eight years and personifies the new energy and spirit of the nation's pioneer dive equipment manufacturer.

U.S. Divers enters the 80's with a new, completely redesigned line of dive suits, featuring its first drysuit in 25 years. The new Aqua-Lung Pro DrySuit is functional, looks good, and features high quality materials and construction. It's made of Kirkhill Neoflex NF 12 one-quarter inch neoprene. The seams are double glued, then a blind locking stitch is used on both sides. Every seam is taped internally with another strip of neoprene.

U.S. Divers uses a Dynat waterproof zipper despite its 40 percent higher cost. Knee pads are standard equipment. At the present time, the suit comes only in black with a yellow panel across the arms and shoulders.

A special hood has been designed to go with the suit. It has an eighth inch smooth neoprene seal around the face and collar to improve water tightness. The hood seal comes below that of the suit to prevent undue restriction around the neck. I wish this suit had been around during my ice diving days.

Of course, the new suit costs about ten times the price of my old '59 model. But let's look at those figures more closely. Today's inflated dollars are worth about 35¢ of the '59 greenback. The old suit fell apart after seven years, but that represented only about 140 dives, a normal one year total for an active California instructor. Today's improved materials and construction should make a suit last for over 300 dives. Those factors alone make the cost reasonable, but you can't put a price on warmth and comfort. Ed Scott explains, "U.S. Divers believes that a diver's longevity in the sport depends on his/her degree of involvement and comfort during the diving experience. One way to assure that comfort is to make sure he or she has the best suit available."

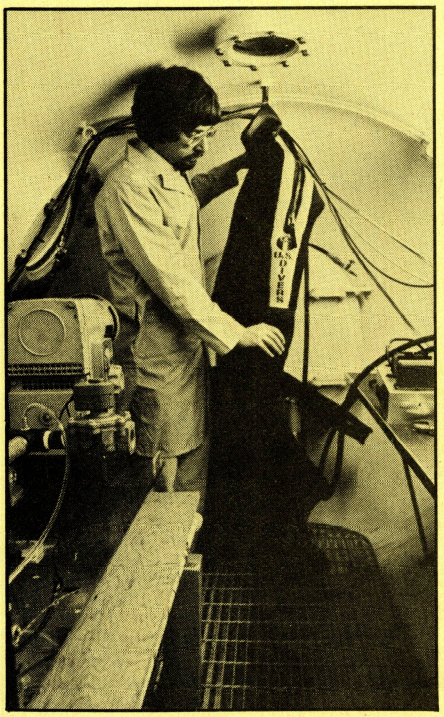
I asked him why the company waited so long to produce a drysuit. Ed replied, "Technology and quality are the answers. We waited until we had mastered both." Actually, two models of neoprene drysuits came off the drawing boards in recent years. Both were advertised in trade publications, but neither one went into production because they did not survive the rigid testing program. Ed explained, "We chose not to release a non-competitive product."

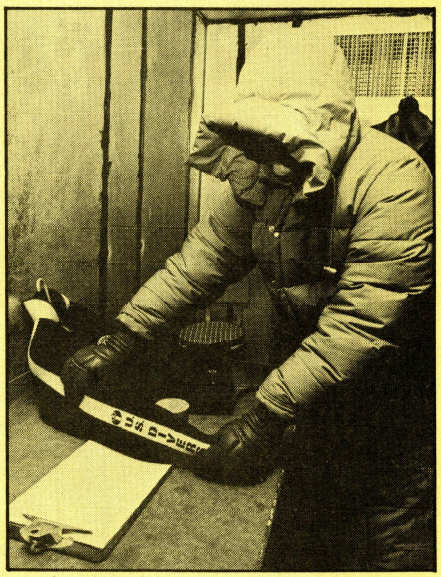
He went on to say that U.S. Divers has a history of many firsts in wetsuits. They were, for example, the first company to bond a nylon lining on wetsuit material. Over the past 20 years, they have manufactured and sold more wetsuits than any other company. However, their designs had fallen behind the times. As a full line manufacturer, they lacked the engineering man hours to update the line. So they hired an outside consultant.

The drysuit, and certain of the new line of wetsuits, was designed by Alan Langton of New Zealand. Langton is the wetsuit production manager for Allan G. Mitchell Company, the U.S. Divers distributor in that country. Owing to high tariffs, Mitchell produces its own suits. New Zealand is noted for producing the world's best wetsuits. "Over there, the code is: quality," Scott explained. "They expect a suit to last ten or more years." Langton brought that approach to his design of U.S. Divers' wetsuit line.

"Alan Langton knows the wetsuit business from the ground up," Ed continued. "He understands pricing, specs and availability of zippers, threads, glue, cleaning solvents, and materials — and knows them on the world market."

Although they have been redesigned, the model names of U.S. Divers' suits remain the same. Besides the drysuit, there is the top of the line Taskmaster II, a stock, custom suit in six sizes. With that many sizes available, most divers can get a custom fit in a suit right off the dealer's rack. The Taskmaster features color accent strips, standard knee and spine pads, thigh and knife pockets.





Above left, a drysuit is prepared for a pressure chamber run. Above right, material flexibility is tested at low temperature. Opposite, Mike Curtis wears a 1955 Seal Suit (a shorty made of sheet rubber) while Tim Wamba models the 1981 Aqua-Lung Pro DrySuit.

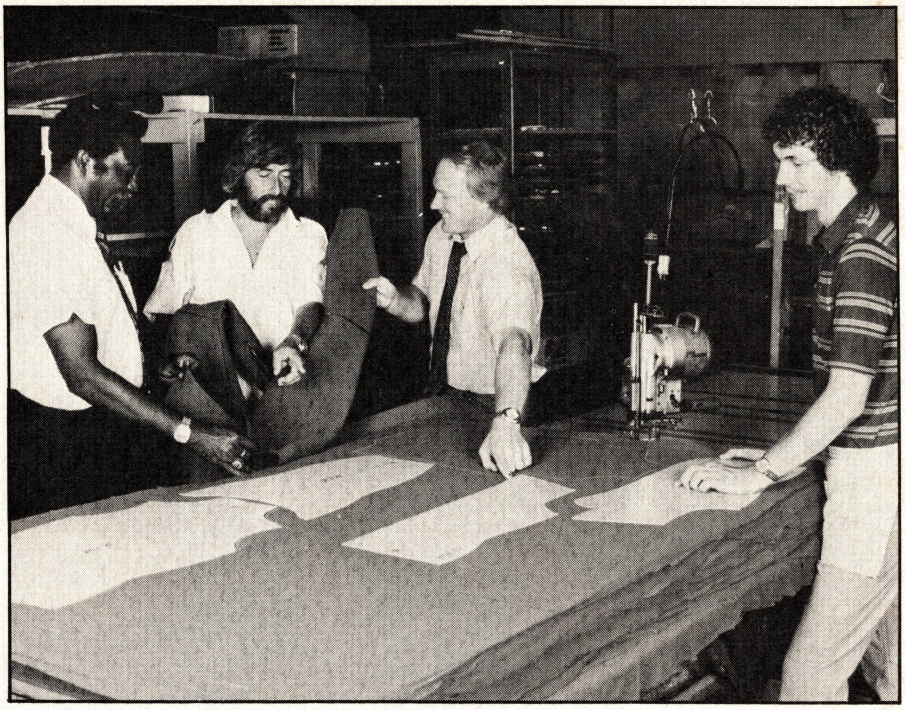

SAMEROJI

The Sea Diver II is the standard suit, also with accent stripes in blue or yellow, and farmer john pants. Although pads and pockets are extra, they share the more expensive suits' serge stitching on all edges and bar tacking at the ankles and wrists.

The Oceanaut is a warm water suit with high waist pants. The basic model, the Super Sport, features a minimum of trim and a nylon 1 lining. Quarter inch models of this suit have glued and sewn seams, while 3/16 inch models have a special yellow seam tape. The Capri II is the women's suit, featuring blue accent trim, high waist pants, and six zippers.

In addition, any suit can be custom made with a choice of colors, materials, accessories, and best of all, a two-week turnaround.

I was curious why the basic color of the suits was black, and asked Ed why more colors weren't offered. He replied that several years ago U.S. Divers led the industry in offering a range of colors in their suits. But, they were ahead of their time and the line flopped. "Look at the ski industry," he continued. "Skiing is a social sport, cosmetically oriented, yet 60 percent of the ski clothing you see is still navy blue. Black and dark blue make you look trim and slim, while lighter blue and some other colors can make a person look like a tank."



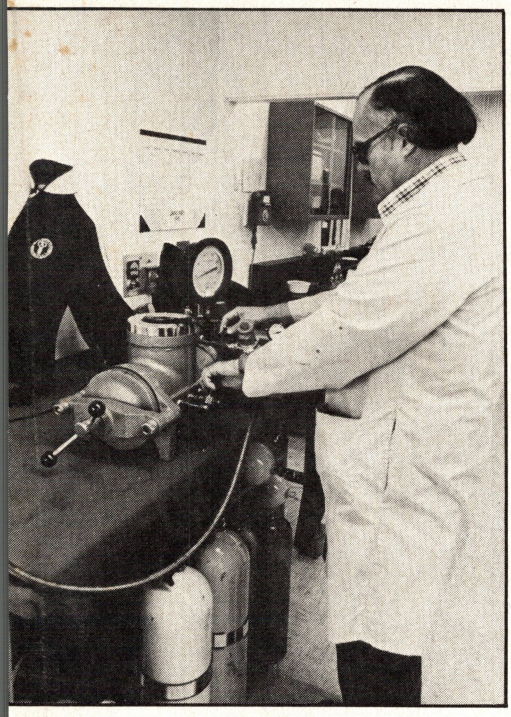
Our final stop was the engineering department, where Ed, along with engineers Paul Owen and Carl Wiesinger, demonstrated some of the rigid tests a suit must pass before it goes into production. Rubber samples were placed in a



That can't be Jack...

I didn't even think he knew how to swim!

Looks like he knows more than we thought...



Opposite, (from left to right) Willie Williams, Jean-Michel Cousteau, Ed Scott and Curtis McFarlane discuss wetsuit patterns. Left, Paul Owen checks the compression set and memory retention of wetsuit material. This will indicate how well the suit will resist creasing.

mini-pressure chamber, repeatedly compressed to 14 atmospheres, then rapidly brought back to sea level. The purpose is to test how the cellular structure withstands repeated pressure changes, a common cause of suit deterioration.

An environmental chamber tests suit flexibility and zipper function at 25 degrees F below zero. A micro-hardness tester determines compression set and memory retention of the material. This shows how a suit will respond to folding and creasing.

A tensile tester measures the maximum stretch of both neoprene and glue. They want to know how many pounds of force it takes to tear the material and/or seams.

Neoprene samples are checked microscopically for the number of threads per inch, to assure uniformity throughout the production run. Suits are sprayed with corrosive chemicals, soaked in chlorinated water, and abused in ways a diver never could equal. Testing of suit materials occurs every three to four months to ensure consistent quality in the delivered materials. I have a friend who is so hard on equipment that a month with him is equivalent to a year of use under normal conditions. These guys are tougher.

Finally, according to Scott, "The test team dives our equipment to the limit. Before it was released, the Pro DrySuit had more use than it would normally get in a year. We have extreme confidence in it."

Ed also expressed extreme confidence in the future of U.S. Divers. Seventeen projects are now in various stages of completion. Included is a second generation drysuit which could include an automatic inflator, and attached boots. They are also looking into new materials for wetsuits. Bonding techniques have reached the point where virtually any material can be bonded to the surface of neoprene. I saw experimental suits with colorful vinyl material on the surface, looking like something out of a science fiction movie.

Ed concluded that divers who are deeply involved in the sport are demanding high technology products to enhance their comfort and efficiency underwater. U.S. Divers recognizes this need and is working to satisfy it.



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The Tobaccofish

(Serranus tabacarius)

The tobaccofish is a sea bass, a representative of the family called the Serranidae. Serranids include the basses and groupers, fishes that can weigh from several ounces to more than 1000 pounds. The tobaccofish is a Caribbean representative of the *Serranus* genus within the family and the fish grows to a maximum length of seven inches. There are 350-400 species of Serranids in all, which makes it one of the largest, and least specialized, of fish families. ☐ It might be difficult for the diver to pin down what is meant by "typical bass-like body," since the body outline of the grouper or large bass will appear quite different from the cigar shape of the smaller species. Typical sea bass characteristics include a large mouth and more importantly a serrated gill flap (called preopercular margin). *Serranus* means "saw-like." ☐ *Tabacarius* comes from the Latin meaning tobacco, and this is in reference to the light brownish-orange, tobacco-stained coloration of the fish. It is also distinctive in that over its pale, almost white, dorsal area it has several large, dark, doughnut-shaped blotches. Also, there will often be two dark stripes on each lobe of the tail. Tobaccofishes have been seen with bright red bellies, and this variation seems to be a characteristic of youth. James Bohlke and Charles Chaplin are two ichthyologists who have seen young tobaccofishes in shallow water with bright, salmon-colored undersides. ☐ Most Serranids — especially the larger ones — are bottom fishes, sitting in caves or near protective ledges when they don't swim and lazing along slowly over the bottom when they do. They tend to be curious and can be lured close to the diver with food or some bright object such as a mirror. The smaller ones, such as the tobaccofish, are more active and wary. They will dart off to hide in a crack in the reef if startled but they will often emerge a little later in some other nearby spot to have a look around. ☐ Serranids exhibit interesting and bizarre sexual characteristics. Some of the larger ones, such as the groupers, start out as females and change to males later in life. Some of the smaller Serranids, such as the *Serranus* and *Hypoplectrus* genera, are hermaphroditic, being male and female at the same time. While the tobaccofish could conceivably impregnate itself, spawning is usually done in groups that include both males and females. ☐ The tobaccofish is found from Bermuda, the Bahamas and south Florida to the Lesser Antilles (Bohlke, Chaplin), and it is seen primarily in deeper water, from 35-100 feet. There are occasional reports of it from shallow water as well — to 15 feet. ☐ Typically the fish will sit on the bottom, propped up on its ventral fins in an alert, predatory way. Tobaccofish feed almost entirely on small fishes but will also go after shrimp and other crustaceans with a nearly equal appetite. It is a solitary species so the diver will most likely see the fish by itself, either sitting on its chosen perch or swimming a few inches off the bottom. ➤

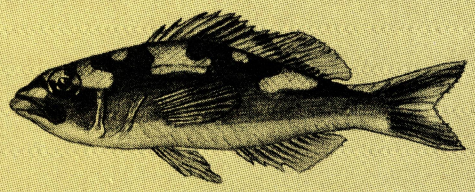


Photo By Chris Newbert - Text By Hillary Hauser

The photo was taken in 50 feet of water off Grand Cayman Island. Newbert used a Canon F-1, with 50mm macro lens, a Hydro 35 housing and Farallon/Oceanic 2003 strobe. Kodachrome 25 film, f16, 10 inches from subject.





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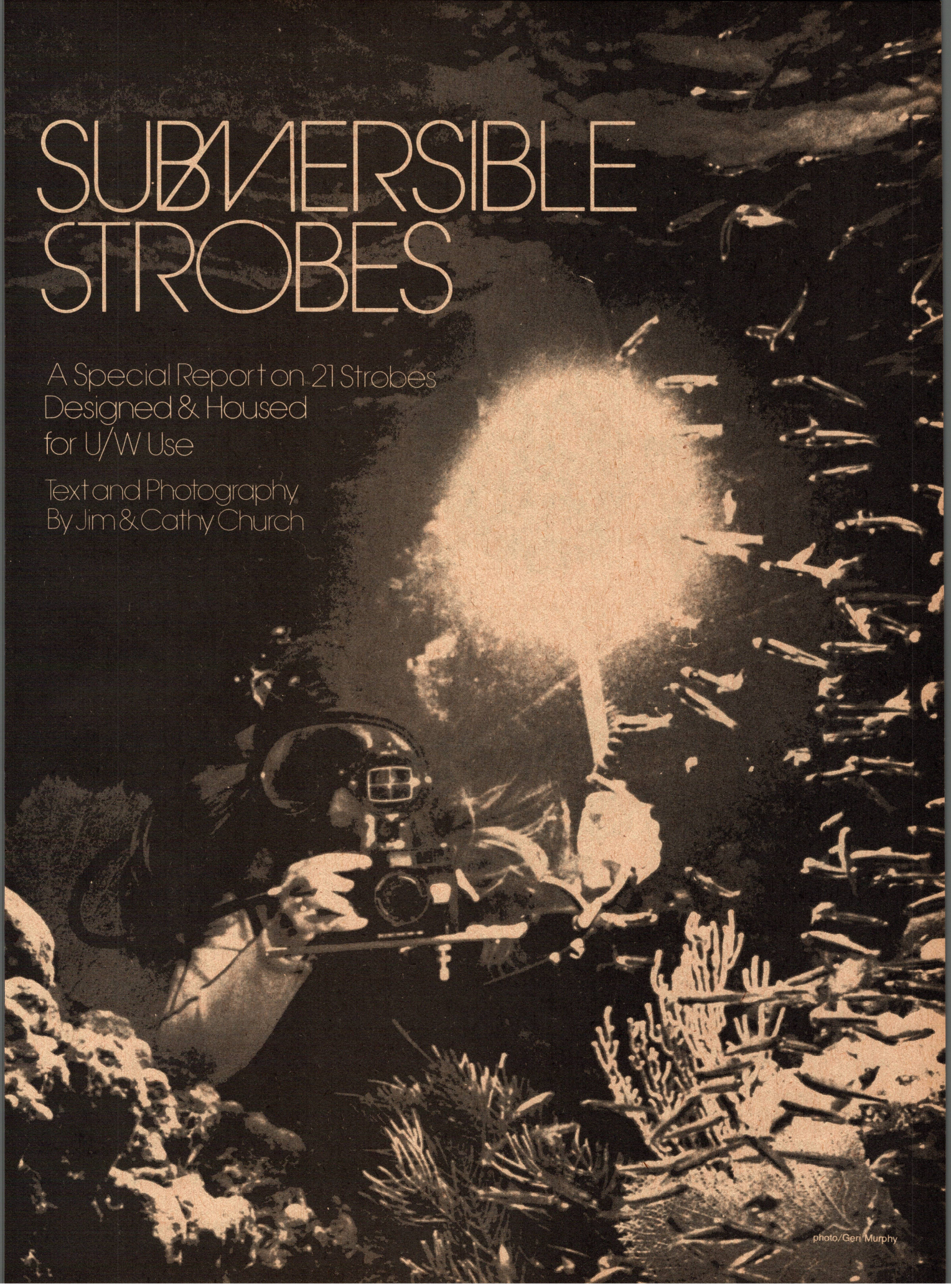
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SUBMERSIBLE STROBES

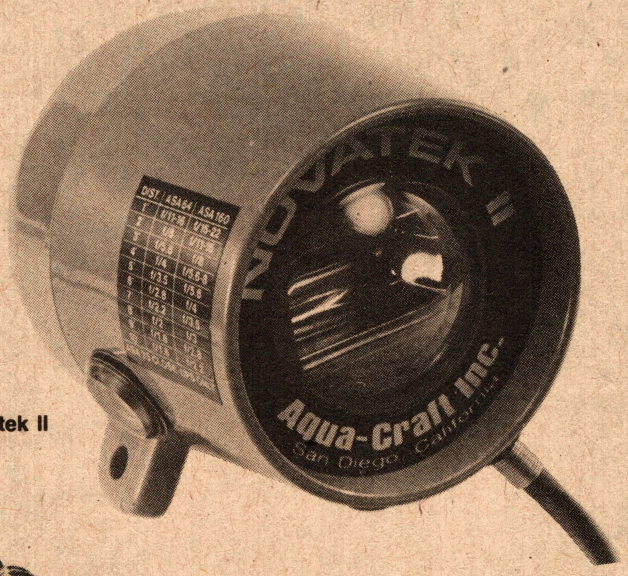
A Special Report on 21 Strobes Designed & Housed for U/W Use

Text and Photography By Jim & Cathy Church

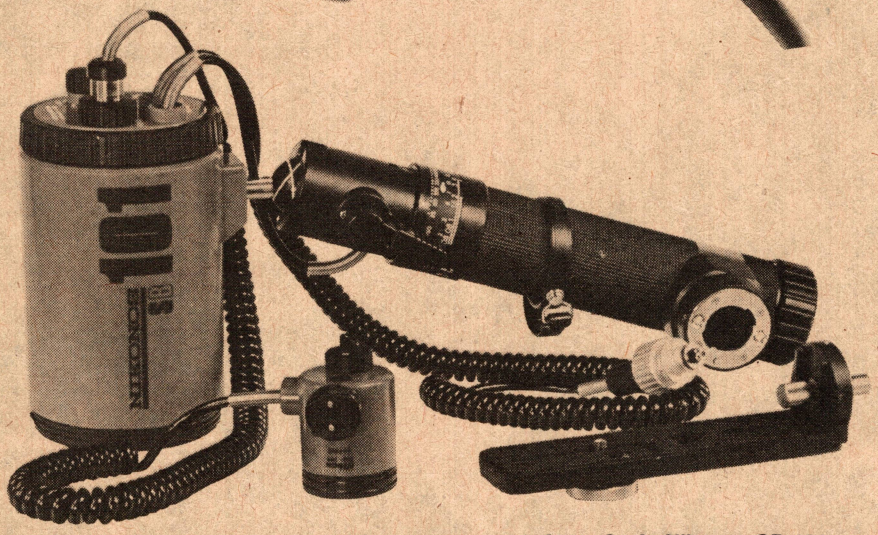


photo/Geri Murphy

SUBMERSIBLE STROBES



Aqua-Craft, Novatek II



Aqua-Craft, Nikonos SB-101

While many of the strobes presented in this roundup can be used in air, all of them are submersibles. They were designed for U/W photography and do not require any special housing.

IKELITE SUBSTROBES

The Ikelite Substrobe 75L and 150L differ from the earlier models in that they are about eight ounces lighter, have longer sync cords with coiled wire flex protectors at each end and the electronics have been updated. The two Substrobes share a common, red plastic body shell. These latest models weren't available at this writing, but externally, they look the same as the older models.

The Substrobe 75L has power settings for 40 and 75 watt-seconds. The built-in ni-cad battery powers up to 300 flashes at 40ws with a 1.5 second recycle time, and up to 150 flashes at 75ws with a three second recycle. The recharge time is four hours with a standard Ikelite charger.

The Substrobe 150L has power settings for 40, 75 and 150 watt-seconds. The removable ni-cad battery pack can be charged in 15 hours with the standard Ikelite or 12 volt chargers, or in three hours with the Ikelite quick charger. This larger battery powers up to 600 flashes at 40ws, 300 at 75ws and 150 at 150ws. The recycle times are about 1.5, three and five seconds, respectively.

Both Substrobes have an optional sync/slave mode, with the slave sensor located at the strobe reflector. They also have 90 degree beam angles, with a built-in modeling light at the center of the reflector. The modeling lights use PR 20 bulbs, easily changed by the user. Either an Ikelite ICS plug (which utilizes the Ikelite SST system) or an optional EO can be used. If the connector is non-Ikelite (non-SST), a small switch inside the strobe is simply set for the non-SST position. Exposures can be estimated with the sliding scale calculators on the rear of the Substrobe bodies. Once these have been preset for ASA film speed and the power setting desired, the scale of suggested apertures is aligned with a scale of U/W distances in apparent feet. The ASA 64 apertures, for a distance of three apparent feet, are f4 at 40ws, f5.6 at 75ws and f8 at 150ws.

The Substrobes are manufactured and serviced by Ikelite (3303 N. Illinois St., Indianapolis, IN 46208). A wide variety of adjustable arms, bracketing systems and other U/W photographic products are also available. Send $1 for a catalogue.

THE LIGHT HANDLE

The Light Handle is a twin strobe system for use with a Nikonos camera. It measures 14 x 3.75 x 11.5 inches, and weighs about three and three-quarters pounds in air. The flashtubes and reflectors are built into the tops of the handles at the left and right sides of the Nikonos camera bracket. A three position knob at the top of each handle can be used to change the angle of the flashtube and reflector inside. At the #1 position, the reflectors angle inward for close-up work; at the #2 position, the reflectors aim ahead for a 100 degree horizontal beam; and at the #3 position, the reflectors aim outward slightly to broaden the horizontal beam to 180 degrees. The right handle (strobe) is triggered by the sync cord. The left handle is a detachable, cordless slave.

Eight AA ni-cad cells, four in each handle, power the strobes. G.E. ni-cads give about 100 or more flashes per charge, with recycle times ranging from about three to five seconds with fresh cells, and seven to ten seconds on the third cassette of 36 exposure film. Although the main off/on switches are on the tops of the handles, mercury switches automatically turn the Light Handle off if it is held upside down or laid on its back. When set for three feet, the U/W guide number is 24 with ASA 64 film.

The Light Handle is manufactured and serviced by Kritter Labs (P.O. Box 88, Hillsboro, OR 97123), and is available in blue, orange, yellow or red. Write for a brochure describing the Light Handle as well as extension tubes and other accessories.

NIKONOS SB-101 SPEEDLIGHT

The SB-101, Nikon's first submersible

strobe, is designed for use with the Nikonos III or IV-A camera. The 3.75 x 6 inch flash head is attached to the 2 x 10.75 inch handle unit with an adjustable swivel joint, and the handle has a quick release mechanism locking it to the Nikonos baseplate.

Power is supplied by eight AA alkaline or ni-cad cells, placed in a removable battery pack that slips into the base of the handle unit. A set of alkalines provides up to about 125 or 150 flashes at full power, with an initial recycle time of about eight seconds. Ni-cad cells give about half as many flashes, but recycle in less than five seconds.

For manual exposure control, the SB-101 has settings for one-quarter and full power. The ASA 64 guide numbers (feet in air) are 42 and 85, respectively. Nikon recommends that the air guide numbers be halved for U/W use. A circular exposure calculator dial, on the handle unit, can be used for estimating U/W exposures as well as exposures in air.

For automatic exposure control, the SB-101 remote sensor can be mounted on either a special sensor bracket that attaches to the Nikonos baseplate, or to the viewfinder accessory shoe. The sensor can be set for two f stops with any given film speed (shown on the calculator dial). With ASA 50, for example, the aperture can be set for either f2.8 or f5.6 and the minimum automatic range (as specified in the owner's manual) is .6m (about 24 inches). Using an earlier model of the SB-101, and ASA 64 film, we found our best automatically controlled exposures were taken at f11-16, at three apparent feet. The circular 50 degree U/W beam angle covers the Nikonos 35mm lens.

The Nikonos SB-101 Speedlight is distributed to U.S. dive shops by Aqua-Craft.

NOVATEK STROBES

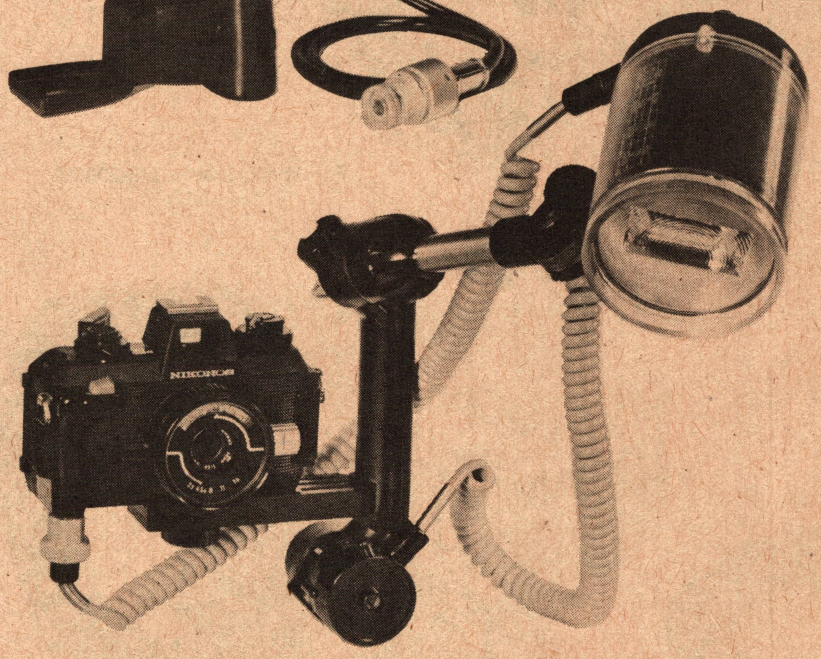
The Novatek II (for the Nikonos I or II) and Novatek III (for the Nikonos III and IV-A) are compact strobes measuring only 3.75 x 4.75 inches and weighing only 25 ounces in air. The body shell is molded in orange Cycolac and an accessory exposure chart can be attached to its side.

The Novatek strobes can be powered by two C alkaline or ni-cad cells. Fresh alkalines power up to about 350 flashes with an initial recycle time of about eight seconds. Ni-cad cells will provide a faster recycle time, but will give fewer flashes. The rectangular reflector, housed behind a dome port, throws a 65 degree diagonal beam angle. The U/W guide number for ASA 64 film is approximately 18.

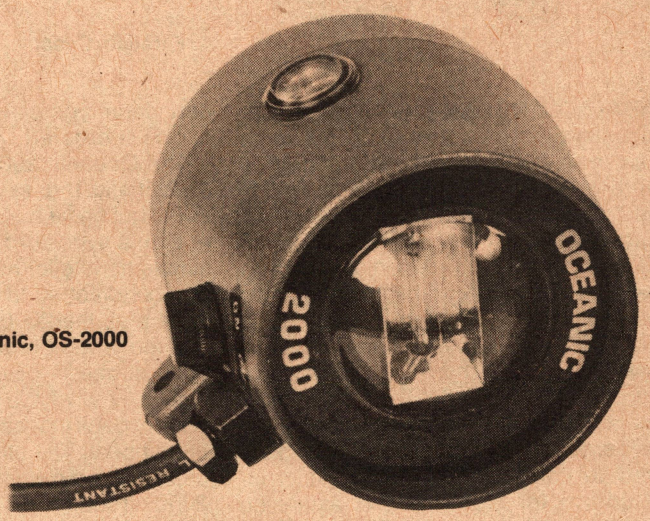
Strobe arm system, baseplates and other accessories are also available. For more details about Novatek U/W photo equipment, write to: Aqua-Craft (7992 Miramar Rd., San Diego, CA 92126). Ask for a free copy of the Wishbook (1981 catalogue).



Berkey Mkt. Co., Sunpak Marine 32

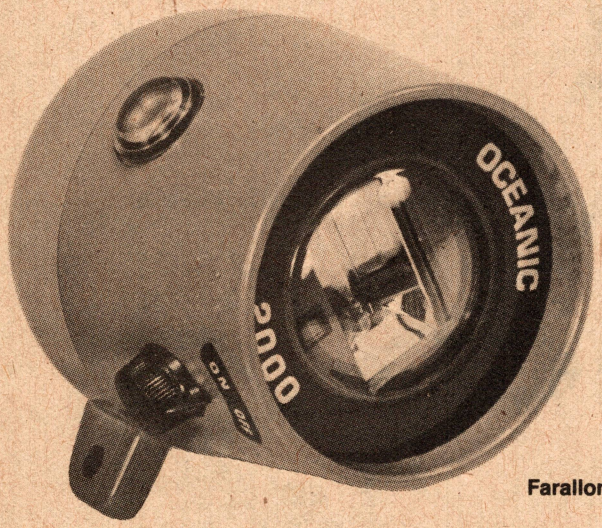


Elmo Mfg. Corp., Toshiba TM-II

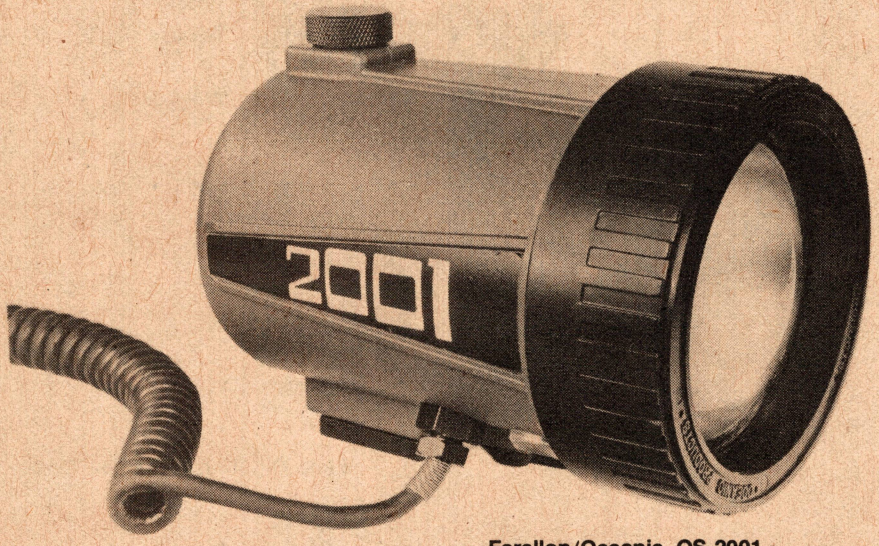


Farallon/Oceanic, OS-2000

SUBMERSIBLE STROBES



Farallon/Oceanic, OS-2000S



Farallon/Oceanic, OS-2001

FARALLON/OCEANIC STROBES

Farallon/Oceanic strobes are available in six models. The two miniature strobes share one molded ABS plastic body shell, and the four wide-beam strobes share another.

The Oceanic 2000 is a miniature strobe measuring 3.75 x 4.75 inches, and weighing only 25 ounces. It gives up to about 300 or more flashes from a pair of C alkaline cells, with an U/W guide number of 16 with ASA 64 film. The recycle time with fresh cells is about six seconds. Rechargeable ni-cad cells can also be used. Its compactness makes it a popular choice for close-up and extension tube photography. A simplified arm and bracketing system is available, and the connector type can be specified when a strobe is ordered.

The Oceanic 2000S cordless slave is essentially the same as the Oceanic 2000, but has a built-in slave sensor rather than a sync cord. It is available with a simple handle for handheld lighting, and can be attached to the same bracketing system as the 2000 sync model.

A rechargeable version of the Oceanic 2000 strobe is being developed at this writing. It will have a removable, ni-cad battery pack that can be charged in six to eight hours. The other specifications are essentially the same as for the regular 2000 strobes.

The Oceanic 2001 is Farallon/Oceanic's basic wide beam, heavy duty strobe. Its molded body measures about 5 x 8.5 inches, and weighs about five pounds in air. Submerged in salt water, it weighs about one-half ounce. It has a 95 degree U/W beam angle, a frosted dome port for even light distribution, and an U/W guide number of 30 with ASA 64 film. Its built-in ni-cad battery gives up to about 360 flashes from a four-hour charge, with a recycle time of about six seconds. The connector can be specified when ordering.

The Oceanic 2002 has the same basic specifications as the 2001, except that it can be used with either automatic or manual exposure control. A remote sensor (the 202 Auto-eye) is built into the sync cord, between the strobe and camera connector. It can be mounted near the camera lens, on an Oceanic handle unit for a Nikonos, or on top of the Oceanic Hydro 35 camera housing. This sensor has three aperture settings. With ASA 64, for example, these are f3.5, f5.6 and f11. To use the Oceanic 2002 automatic exposure control: (1) Begin with an exposure meter reading off the subject. (2) Set the Auto-eye for an f number that is equal to, or higher than, the metered f stop. (3) Set the lens aperture for the same f stop as the Auto-eye. (4) Focus, and take the picture. Manual exposure control is recommended for close-up work with supplementary close-up lenses or extension tubes. The Oceanic 2002 is supplied with an EO connector only.

The Oceanic 2003 has settings for both low and high power. The built-in ni-cad battery gives about 360 flashes, depending on the power settings used. At high power the light output is equal to that of the Oceanic 2001, an U/W guide number of 30 with ASA 64 film. And at low power, the guide number is reduced to 19. This lower power setting can be used whenever soft, delicate lighting effects are needed. A Nikonos or EO connector can be specified.

All of the Oceanic wide-beam strobes — models 2001, 2001S, 2002 and 2003 — have built-in GE Gold Top Ni-cads, a frosted dome port over a circular reflector, and a 95 degree U/W beam angle. An accessory charger is supplied with each strobe. The charger plugs into a port at the upper rear of the strobe body and a standard 110 volt wall outlet, and charges the battery in four hours. These strobes have recycle times of about six seconds or less. A wide variety of interchangeable ball joint arms, Nikonos baseplates, exposure meter mounts, exposure table decals, etc., are also available. The strobes, and most other accessories, have a blue finish. Oceanic strobes are produced and serviced by Farallon/Oceanic (14275 Catalina St., San Leandro, CA 94577). Send $3 for a catalogue.

SEA & SEA YS STROBES

The Sea & Sea Yellow-Sub 50 and Yel-

low-Sub 150 have body shells of molded, yellow plastic. The YS-50 is the compact, normal beam model, and the YS-150 is the larger wide beam model.

The YS-50M is designed for manual exposure control. The strobe measures 4.9 x 6.4 inches and weighs 2.2 pounds. It is powered by four AA alkaline or ni-cad cells. Alkaline cells give up to 250 flashes with an initial recycle time of five seconds; ni-cads give about 130 flashes with a 3.5 second recycle time. An exposure decal on the rear of the flash head indicates an ASA 64 aperture of f5.6-8 for a strobe-to-subject distance of three apparent feet. The single switch has positions for off, on, test flash and slave. The built-in slave sensor is located at the top of the strobe body.

The U/W beam angle is specified as covering a Nikonos 28mm lens, and a special beam-spreading filter can be placed behind the port (when the YS-50M is opened) to widen the beam to cover a 20mm lens.

An automatic exposure control model — the YS-50A — is also available, but we haven't been able to examine it at this writing. It is essentially the same as the manual model, but can be used with a remote sensor that allows a choice of four apertures at ASA film speeds from 25 to 400.

The YS-150 has a circular U/W beam angle of 100 degrees, and can be used at full or half power in either the sync or slave mode. The strobe head measures 4.7 x 9.5 inches and weighs 4.75 pounds.

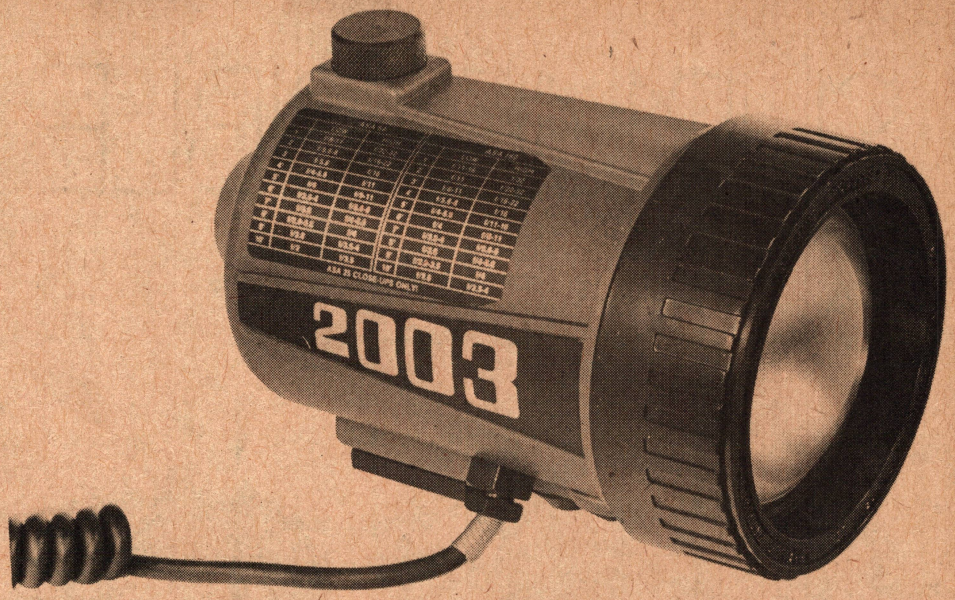
The removable ni-cad battery pack powers up to 100 flashes at full power, with a four second recycle time; up to 200 flashes at half power with a two second recycle. We estimate the ASA 64 apertures to be f5.6 at half power and f8 at full power, at a strobe-to-subject distance of three feet.

All of the YS strobes discussed have a color temperature of 5500K, a recharging time of 12 hours with ni-cads, and are available with SeaLoc or Nikonos connectors. Also available are a miniature YS-20 strobe (for which we have no data at this writing), arms, brackets, meter mounts, extension tubes, camera housings and other items.

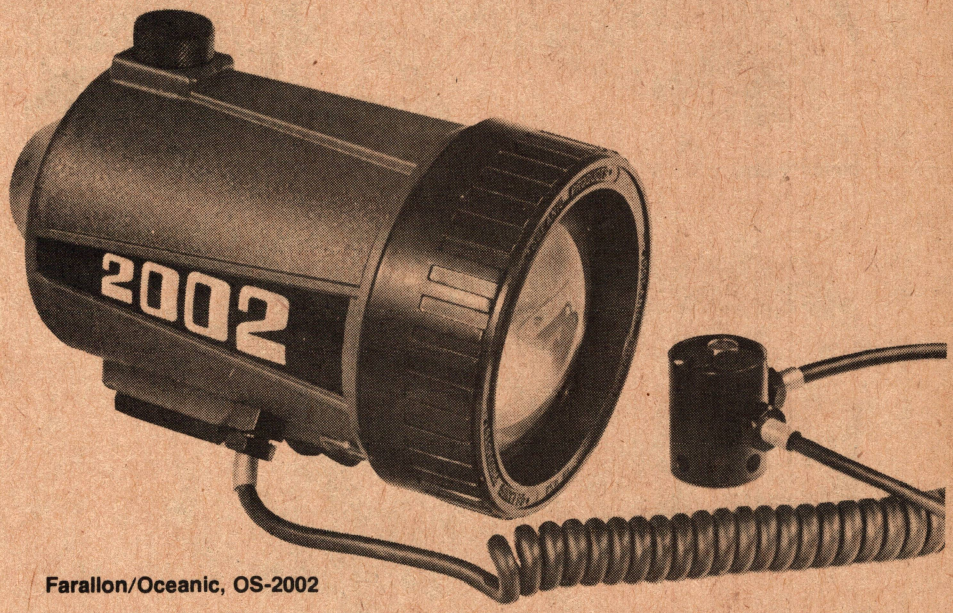
The U.S. distributor (and repair center) is Sea & Sea, U.S.A. (439 Mola Avenue, Ft. Lauderdale, FL 33301). Write for details. The Canadian distributor is: Aquanaut Photo Systems, Ltd. (304-1791 Rockland Ave., Victoria, B.C. V8S 1XL).

SR2000 STROBES

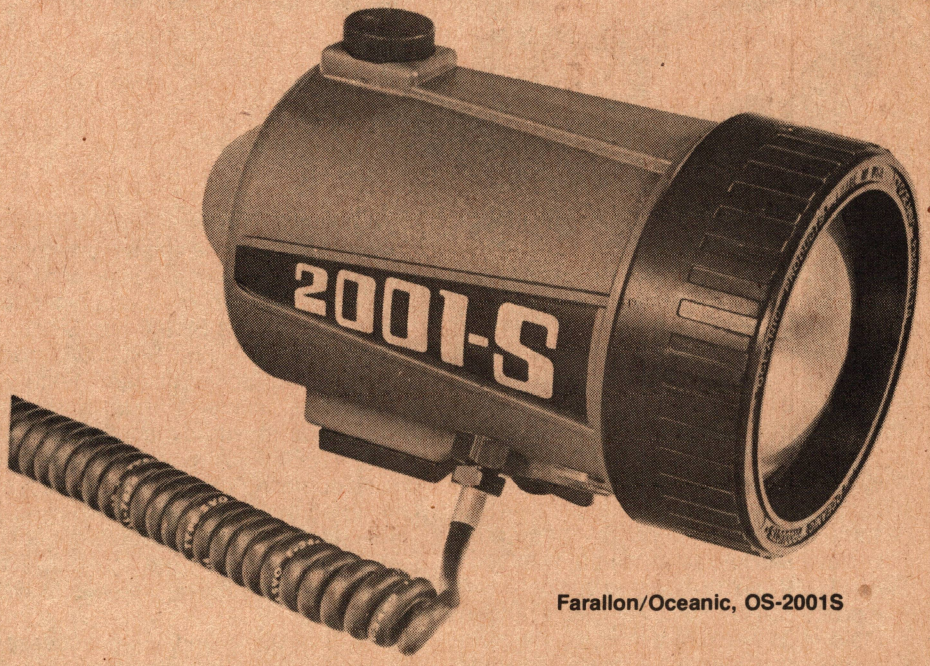
The SR (Sonic Research) strobes are a family of four miniature strobes measuring about 2.3 x 5 inches and weighing about 15 ounces each. The general appearance and basic specifications of each strobe are the same, but the four models differ in the number of special features offered. Their characteristics and catalogue numbers are as follows:



Farallon/Oceanic, OS-2003

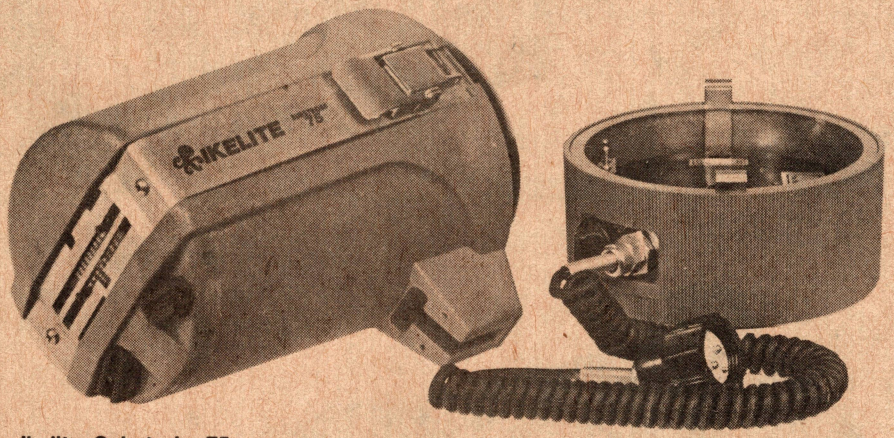


Farallon/Oceanic, OS-2002

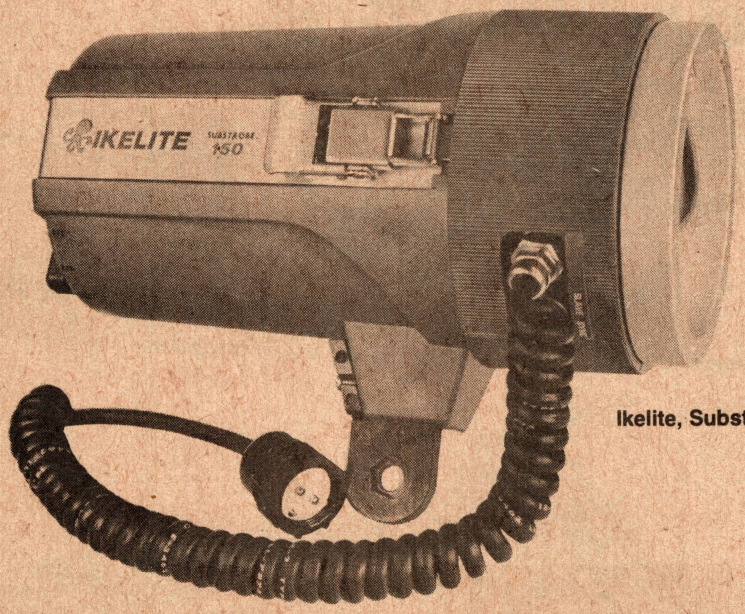


Farallon/Oceanic, OS-2001S

SUBMERSIBLE STROBES



Ikelite, Substrobe 75



Ikelite, Substrobe 150

Model SR200 is the basic sync model. It has a built-in ni-cad battery that gives up to 250 flashes from a 15 hour charge, with a recycle time of about two seconds. The beam angle covers the Nikonos 35mm lens and an accessory beam widener is available for wide-angle work. The U/W guide number for ASA 64 film is approximately 24.

Model SR210 is a cordless slave strobe designed specifically for multiple lighting techniques. It is essentially the same as the sync model, but has a built-in slave sensor rather than a sync cord. An SR210 can be mounted beside a sync model — on the Sonic Research Tandem Plate — to either increase the beam intensity, or to widen the beam by adjusting the strobe angles.

Model SR202 is the combination sync/slave model. It has both a sync cord and a built-in slave sensor. It combines the features of models SR200 and SR210.

Model SR202A (the SR2000A) combines all of the Sonic Research features. It has sync, slave, manual and auto modes. The remote sensor is programmable from f5.6 to f16, with ASA 64, and has an operating range from 1 to 12 feet. One important advantage of having a slave with automatic exposure control is that you can program the light output to avoid overexposing near subjects with the slave.

Arm, bracketing and swivel accessories are available for attaching one or more Sonic Research strobes to a Nikonos or housed camera system. Each strobe has 55mm accessory threads at the front edge, immediately in front of the flat reflector port. Color or neutral density filters can be screwed directly into these threads, above or below the surface, for special lighting effects.

All of the SR2000 strobes have a white plastic finish, but neoprene booties in various colors are available. These fit over the strobe bodies and provide protection against any impacts. And for cold water diving, the booties help insulate the strobes and prevent the batteries from chilling.

SR2000 strobes are manufactured and serviced by Sonic Research (5121 Santa Fe Street, Suite C, San Diego, CA 92109). Send $1 for a complete catalogue.

SUBSEA STROBES

Each of the four Subsea strobes has a different size, weight and body shell, but all can be used with a common arm and bracketing system.

The Mark 30 is the smallest of the Subsea line. It measures 3.25 x 6 inches, and weighs slightly less than two pounds. Replacing the earlier Mark 25, the new Mark 30 is powered by three alkaline or ni-cad C cells. It features a voltage regulating circuit to maintain stable light output. Subsea specifies that you get up to 450 flashes of equal light output; beyond the 450 flashes, light output declines. Recycle time with alkalines, however, will increase as the cells wear out. Recycle time is 6.5 seconds with fresh alkalines and less with ni-cads. The Mark 30 has a 60 degree diagonal U/W beam angle, and an U/W guide number of about 24 with ASA 64 film. An ASA 64 exposure table is molded on the rear of the strobe body. The Mark 30 is available with Nikonos or EO connectors.

The Subsea Mark 100 is the smallest of the wide-beam Subsea strobes. It measures 4.5 x 9 inches, weighs 3.5 pounds in air, and throws a 90 degree U/W beam angle. It is powered by a disposable, 300 volt Eveready No. 493 battery which gives up to 1500 flashes at the full (100 watt-second) power setting, and up to 750 flashes at the half (50 watt-second) setting. The U/W guide number is about 24 with ASA 64 film at full power. It is available with an EO connector.

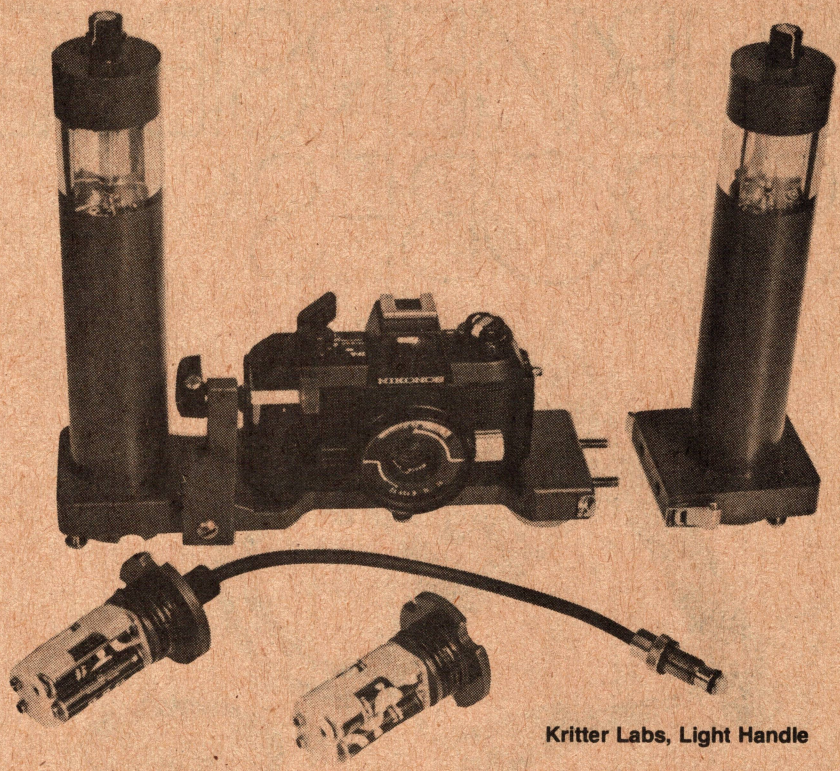
The Subsea Mark 150 measures 5.5 x 10 inches, and weighs 6.5 pounds in air and 6.5 ounces in water. It features an U/W beam angle adjustable from 90 to 150 degrees; power settings for 50, 100 and 150 watt-seconds; and both sync and slave modes. The built-in slave sensor is located near the flashtube. It is powered by a disposable, 510 volt Eveready No. 497 battery that gives a minimum of 1500 flashes at 50ws, 750 at 100ws and 500 at 150ws. The Subsea accessory exposure decal suggests apertures of f5.6, f8 and f11 (for 50, 100

and 150ws) at an U/W distance of three feet with ASA 64 film.

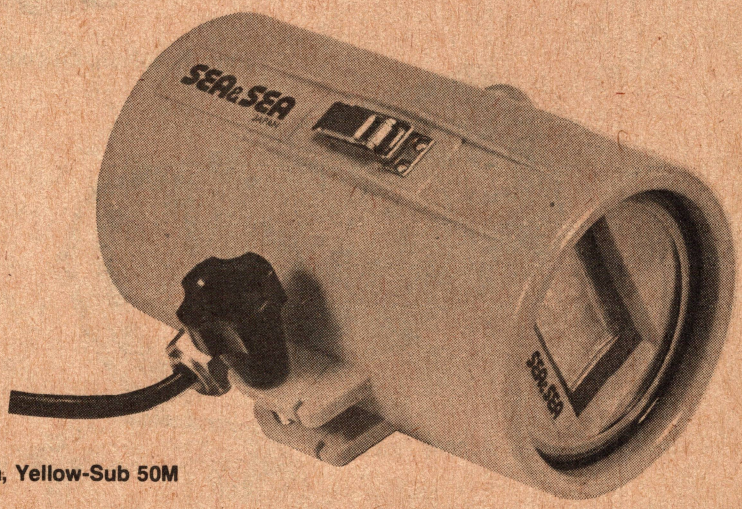
The latest model Mark 150 has two significant improvements: (1) The user can change the sync cord with only a single wrench. The cord has a plug-in rather than a soldered connection. (2) The user can also change the main circuit board. The only tools needed are a pair of long-nose pliers and a capacitor discharger (available from Subsea). The connections are plug-in and don't require soldering. The Mark 150 is available with either a Nikonos or EO connector.

The Subsea Mark 225 is the top of Subsea's line. It features a 110 degree beam angle; built-in modeling light; power settings for 75, 150 and 225 watt-seconds with recycle times of two, four and 6.5 seconds, respectively. The built-in ni-cad battery powers up to 300 flashes at 75ws, 200 at 150ws, and 100 at 225ws, with a recharge time of seven hours. An accessory exposure table decal shows apertures of f8, f11 and f16 (for the three power settings) at three feet with ASA 64 film. The Mark 225 measures 5.5 x 11 inches, weighs 9.5 pounds in air and 3.5 ounces in water, and is supplied with an EO connector.

All of the Subsea wide beam strobes — the Mark 100, 150 and 225 — have dome ports and beaded reflectors that provide soft, wide beam lighting. The finish is usually molded black plastic, but special production runs with other colors are sometimes made. Subsea strobes are manufactured and serviced by Subsea Products (1006 West 15th Street, Riviera Beach, FL 33404). Write for free specification sheets. Arms, brackets, Nikonos trays and connectors are also available from Subsea. The West Coast Subsea Products authorized repair center is at 1010 Daisy St., Escondido, CA 92027.



Kritter Labs, Light Handle



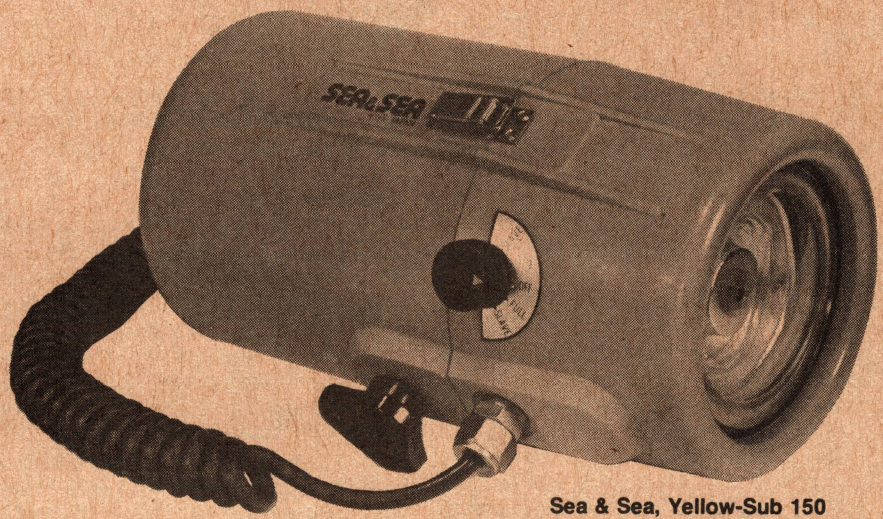
Sea & Sea, Yellow-Sub 50M

SUNPAK MARINE 32

The new Sunpak Marine 32 replaces the Marine 28. We haven't examined the Marine 32 at this writing, but the manufacturer's specifications are as follows:

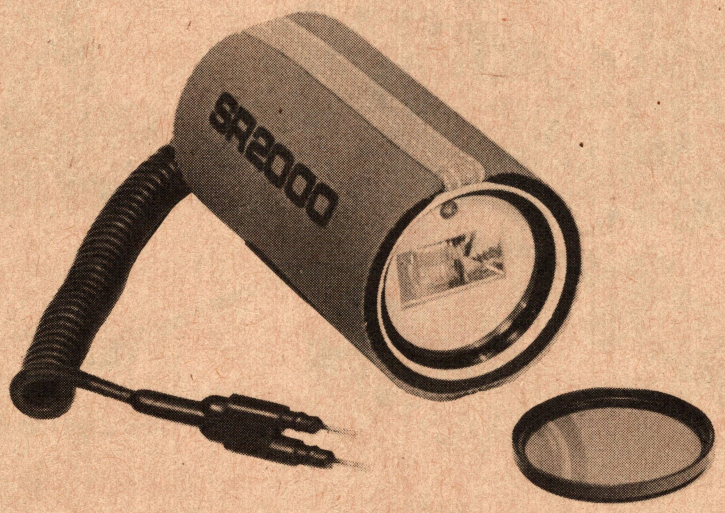
It can be used at either full or half power, in either the sync or slave mode. The switches are magnetic and don't penetrate the outer housing. Should the strobe accidentally flood, an alarm light turns on. The electronics are insulated and won't be damaged if the battery compartment should flood. The flash head has an outer rubber covering to absorb the shock of any impacts. The flash head is attached to the handle unit with a ball and socket joint, and the handle is molded to form a pistol grip. The handle detaches from the Nikonos baseplate with a quick release lock. The sync cord can be supplied with a Nikonos III or IV-A connector, plus an adapter for a Nikonos I, II or Ikelite housing.

Six alkaline or ni-cad AA cells, inside the handle, power the Marine 32. At full power, alkaline cells will give up to 75



Sea & Sea, Yellow-Sub 150

SUBMERSIBLE STROBES



Sonic Research, SR 2000 (#200)



Sonic Research, SR 2000 (#210)

flashes with a seven second recycle time, and 150 flashes at half power with a four second recycle time. Ni-cad cells give about half as many flashes, but with shorter recycle times of five and three seconds, respectively. A ni-cad battery pack, with a three hour charger, is also available.

The U/W beam angle covers a Nikonos 35mm lens. A wide-angle adapter is available to widen the beam to cover the 28mm lens, and an ultra-wide adapter covers a 20mm lens. These fit over the front of the strobe.

The Sunpak Marine 32 measures about 4 x 7.2 inches, weighs 31.8 ounces, and has a color temperature of 5500K. For more details, contact: Sunpak Division, Berkey Marketing Companies (25-20 Brooklyn-Queens, Expressway West, Woodside, NY 11377).

TOSHIBA TM-II

The Toshiba TM-II (which supercedes the Toshiba TM-I) comes complete with a Nikonos baseplate, adjustable arm and remote sensor. The flash head measures 3.7 x 5.5 inches, the sensor measures about 1.9 x 1.3 inches, and the total system weighs three pounds.

For manual exposure control, the chart on the side of the flash head shows U/W guide numbers of 20 for ASA 50/64, 28 for ASA 100 and 56 for ASA 400. And for automatic exposure control, the chart shows a choice of two apertures (either f2.8 or f8 for ASA 50 or 64) for each film speed. The remote sensor attaches to the bottom of the handle, at the lower left of the camera body, but can be moved or have its angle changed. The flash head is also adjustable with the arm.

With manual exposure control, four size AA alkaline cells give up to about 130 flashes with a seven second recycle time for fresh cells. Ni-cad cells power about 40 flashes with a four second recycle. With automatic exposure control, recycle times and number of flashes vary with the apertures selected and strobe-to-subject distances used.

The beam angle is specified as covering a 35mm lens, and the color temperature is specified as being the same as daylight. For additional details, contact: Elmo Mfg. Corp. (70 New Hyde Park Road, New Hyde Park, NY 11040).

CHOOSING A SUBMERSIBLE STROBE

Sorry, but there isn't any single submersible strobe that is universally best for all photographers and situations. You must compromise between: (a) the features you require, (b) the disadvantages you will accept, and (c) the price you are willing to pay. The compromises between features and disadvantages is a tricky area because any given characteristic — such as the battery system or beam angle — may be an advantage or disadvantage, depending on your particular needs. Therefore, in this roundup, we will discuss the strobe characteristics you need to understand when choosing a strobe, and will present the submersible strobes most commonly used by U.S. U/W photographers. The decision of what is best is up to you.

ALKALINE CELL POWER

Many small submersible strobes are powered by alkaline AA or C cells. The small size of the cells helps reduce the size and weight of the strobe and the cells are usually available at retail outlets. Alkalines are often preferred over ni-cad cells because they usually give more flashes before exhaustion and don't require electrical outlets for recharging. From a cost standpoint, alkaline cells may be a more economical power source if you use the strobe infrequently. As for disadvantages, recycle time increases, and light output declines with some strobes, as the cells wear out.

NI-CAD CELL POWER

AA and C ni-cads are sometimes used in place of alkaline cells. The ni-cads can be recharged hundreds of times, thus are more economical for frequent use. During use, ni-cads maintain a more constant voltage level. Thus, both recycle time and power output will be more stable. With simpler, unregulated strobes, however, the light output may be about one-quarter or one-third stop less than with new alkalines. New ni-cad cells may

not give the rated number of flashes until the cells have been charged and used three or four times. Warning: Read the owner's manual before using ni-cads in place of alkalines. The faster recycle time with ni-cads can overheat the electronics and damage the strobe. Therefore, some manufacturers warn against using ni-cads. If no warning is given, we usually go with the ni-cads.

BUILT-IN NI-CAD BATTERIES

Several submersible strobes feature built-in ni-cads. Recharging is usually simple: Unscrew a charge plug, plug a charger cord into the strobe, and charge from a wall outlet for several hours. You eliminate the fuss of changing batteries and cleaning contacts, but the strobe is out of action during the charging time. Look for a battery system that will power enough flashes for a full day's diving before recharging is necessary.

REMOVABLE NI-CAD PACKS

A removable ni-cad pack contains a number of individual cells that are packaged as a unit. Two removable packs offer more versatility than a built-in battery. One pack can be used to power the strobe while the other is being recharged. And if a problem develops with a battery pack, you don't have to send the entire strobe in for repair — just the pack.

HIGH-VOLTAGE BATTERIES

Disposable 300 and 510 volt batteries have several advantages when compared to other systems: (a) They can power hundreds of flashes before replacement. This is an important advantage during extended trips to remote areas without power. (b) When compared to alkaline power, the increase in recycle time as the battery wears out isn't as drastic. As for disadvantages: (a) High-voltage batteries are more expensive than alkaline cells and are difficult to find in retail outlets. (b) As voltage drops with age and use, recycle time slowly increases, and the strobe light output slowly declines. To extend battery life, alternate two batteries and refrigerate them during storage.

MULTIPLE POWER SETTINGS

With multiple power settings, the power can be reduced whenever less light is needed, and this extends battery life. You can also use multiple power settings to bracket exposures if you don't wish to change aperture or strobe-to-subject distance.

Power settings for full and half power should be one f stop apart in light output. If settings are in watt-seconds, you must generally double the watt-seconds to gain an additional f stop. If a 50ws setting gives an f5.6 exposure, for example, a 100ws setting should give f8. Power settings for high and low could mean anything — best check the manufacturer's



Subsea Products, Mark 30



Subsea Products, Mark 100



Subsea Products, Mark 150

SDM GUIDE TO SUBMERSIBLE STROBES

COMPANY	MODEL	SIZE (INCHES); WEIGHT IN AIR	BATTERY SYSTEM	CHARGING TIME	NO. POWER SETTINGS	FLASHES PER FRESH BATTERY	RECYCLE TIME (SECONDS)	ASA 64 APERTURE, THREE APPARENT FEET	NO. AUTO APERTURES	U/W BEAM ANGLE
AQUA-CRAFT 7992 Miramar Rd. San Diego, CA 92126	NOVATEK II & III	3.75 x 4.75 25 oz.	2C		1	350 alk	8	f5.6		65d
	NIKONOS SB-101 (auto/manual)	3.75 x 6 5.5 lbs.	8AA		1/4 full	 150 alk	3 8	f5.6-8 f11-16	2	50c
BERKEY MKT. COMPANIES 25-20 Queens Blvd. Woodside, NY 11377	SUNPAK MARINE 32 (sync/slave)	4 x 7.2 3.6 lbs.	6AA		half full	150 alk 80 alk	4 9	f8-11 f11-16		39 x 66 *
ELMO MFG. CORP. 70 New Hyde Park Road New Hyde Park, NY 11040	TOSHIBA TM-II (auto/manual)	3.7 x 5.5 3 lbs.	4AA		full auto	130 alk	7	f8	2	35mm
FARALLON/OCEANIC 14275 Catalina St. San Leandro, CA 94577	OS-2000	3.75 x 4.75 25 oz.	2C		1	300+ alk	6	f5.6		65d
	OS-2000S (cordless slave)	3.75 x 4.75 18 oz.	2C		1	300+ alk	6	f5.6		65d
	OS-2001	5 x 8.5 5 lbs.	BNC	4	1	360	6	f11		95c
	OS-2001S (sync/slave)	5 x 8.5 5 lbs.	BNC	4	1	360	6	f11		95c
	OS-2002 (auto/manual)	5 x 8.5 5 lbs.	BNC	4	full auto	360+	2-6	auto	3	95c
	OS-2003	5 x 8.5 5 lbs.	BNC	4	low high	280 to 430	4 6.5	f5.6 f16		95c
IKELITE 3303 N. Illinois St. Indianapolis, IN 46208	SUBSTROBE 75L (sync/slave)	5.25 x 10.25 7.5 lbs.	BNC	4	40ws 75ws	300 150	1.5 3	f4 f5.6		90c
	SUBSTROBE 150L (sync/slave)	5.25 x 10.25 7.7 lbs.	RNC	3 or 15	40ws 75ws 150ws	600 300 150	1.5 2 3	f4 f5.6 f8		90c
KRITTER LABS P.O. Box 88 Hillsboro, OR 97123	LIGHT HANDLE (twin Strobes)	14 x 4 x 12 3.75 lbs.	8AA		1	100 ni	6	f8		to 180w
SEA & SEA, U.S.A. 439 Mola Avenue Ft. Lauderdale, FL 33301	YELLOW-SUB 50M (sync/slave)	4 x 6 2.2 lbs.	4AA	12	1	250 alk 130 ni	5	f5.6-8		28mm *
	YELLOW-SUB 50A (auto/manual)	4 x 6.25 2.2 lbs.	4AA	12	full auto	250 alk 130 ni	5	auto	4	28mm *
	YELLOW-SUB 150 (sync/slave)	5 x 9 4.75 lbs.	RNC	12	half full	200 100	2 4	f5.6 f8		100c
SONIC RESEARCH 5111 Santa Fe, Suite H San Diego, CA 92109	SR2000, #200 (sync model)	2.3 x 5 15 oz.	BNC	15	1	250	2	f8		65c
	SR2000, #210 (cordless slave)	2.3 x 5 15 oz.	BNC	15	1	250	2	f8		65c
	SR2000, #202 (sync/slave)	2.3 x 5 15 oz.	BNC	15	1	250	2	f8		65c
	SR2000A (auto/ manual/sync/slave)	2.5 x 5.25 18 oz.	BNC	14	1	225 man. 350 auto	3	f8	4	58c
SUBSEA PRODUCTS 1006 West 15th St. Riviera Beach, FL 33404	MARK 30	3.25 x 6 2 lbs.	3C		1	450+ alk	6.5	f8		60c
	MARK 100	4.5 x 9 3.5 lbs.	300v		50ws 100ws	1500 750	3 6	f5.6 f8		90c
	MARK 150 (sync/slave)	5.5 x 10 6.5 lbs.	510v		50ws 100ws 150ws	1500 750 500	2 4 6	f5.6 f8 f11		90-150c
	MARK 225	5.5 x 11 9.5 lbs.	BNC		75ws 150ws 225ws	300 200 100	2 4 6.5	f8 f11 f16		110c

NOTES:
*Special beam wideners available, see text.
Data taken from manufacturers' specifications, and may differ from past, present or future publications because of design changes.
ASA 64 apertures based on manufactuers' data. The actual exposures you use will vary with subject and water conditions. Exposure data not truly comparable because of different standards used.

ABBREVIATIONS
alk — alkaline cells
ni — ni-cad cells
BNC — built-in ni-cad battery
RNC — removable ni-cad battery
v — volt
ws — watt-second
NA — not available
35mm —covers 35mm lens

SUBMERSIBLE STROBES

COLOR TEMP. DEGREES KELVIN	MODELING LIGHT	CONNECTOR	PRICE
dl	no	N EO	$270.00 $300.00
dl	no	N	$565.00
5500	no	N	$379.00
dl	no	N	$299.95
dl	no	N, EO I	$235.00 $245.00
dl	no		$235.00
5800	no	N, EO	$550.00
5800	no	EO	$605.00
5800	no	EO	$730.00
5800	no	N, EO	$650.00
5800	yes	I EO	$349.95 $429.95
5800	yes	I EO	$495.00 $574.95
dl	no	N	$475.00
5500	no	SL N	$330.00 $320.00
5500	no	SL N	NA
5500	no	SI N	$590.00 $580.00
6000	no	SL EO	$264.00 $283.00
6000	no		$264.00
6000	no	SL EO	$286.00 $304.00
6000	no	SL	$350.00
dl	no	EO N	$309.50 $298.50
5500	no	EO	$499.60
5500	no	EO N	$599.95 $588.30
5500	yes	EO	$899.95

dl — daylight
N — Nikonos connector
EO — EO connector
I — Ikelite (ICS) connector
SL — SeaLoc connector
d — diagonal
c — circular
w — width
28mm — covers 28mm lens

specifications.

The actual differences between power settings are sometimes different than those stated in manufacturer's specifications. This is due to differences in the ages, condition, and manufacturing tolerances of the storage capacitors. Therefore, we recommend that you purchase a flash meter (an incident-reading exposure meter that measures the light intensity of a strobe flash) and take comparative flash meter readings before each photo trip. We never take a photo trip without one.

While multiple power settings increase the versatility of the strobe, they do add to cost and complexity.

COMPARING LIGHT OUTPUTS

Light output may be expressed in guide numbers, watt-seconds or with exposure tables of apertures and distances. Comparing light output specifications is often difficult because manufacturers are free to choose their own standards. And in some cases, the tendency is to overstate the output.

A guide number, when divided by strobe-to-subject distance, gives an estimated aperture. With a guide number of 24, for example, and a strobe-to-subject distance of three feet, the estimated aperture is f8 (24/3 = 8). The guide number, of course, varies with the film speed.

A guide number for exposures in air must be divided by a correction factor to reduce it to an U/W guide number. This is necessary because some of the light is absorbed and blocked as it passes through water. The value of the correction factor depends largely on the shapes of the reflector and port. A deep reflector, housed behind a flat port, tends to concentrate the light into a narrow beam. Thus, a relatively small factor — such as two — may be used. But with a competing strobe, having a shallow reflector and dome port that spreads the beam of light over a wide area, a larger correction factor of three or 3.5 might be needed.

Watt-seconds is a measurement of the energy stored in the capacitors, not a direct measurement of light output. As a rule of thumb, watt-seconds must be doubled to increase light output by one f stop.

Exposure tables, which show suggested apertures and distances, are sometimes provided. You don't, however, know how the table was derived; it may be based on dividing air guide numbers by a correction factor, flash meter tests in a reflective pool, or by someone's film test in open water.

COMPARING BEAM ANGLES

A diagonal or circular U/W beam angle less than about 60 degrees will cover the picture area of a 35mm lens behind a flat port, and covers the central area of a 28mm lens. A normal beam strobe (about a 60 degree beam angle) is great for close-up work, or with a 35mm lens at longer distances, but can only be used for accent lighting with wide-angle lenses.

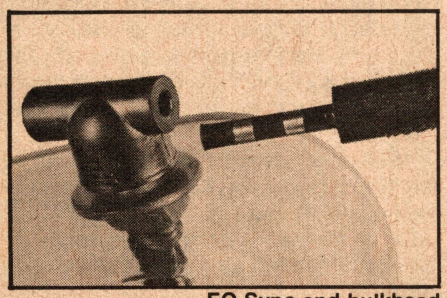
If the strobe reflector is behind a flat port, the U/W beam angle will be reduced to about three-fourths of the beam angle in air. This is because of refraction (bending) of light at the air/plastic/water interfaces.

Wide-beam strobes, with beam angles of 90 degrees or more, are usually used with wide-angle lenses. These strobes are usually larger and heavier than the normal beam strobes, and have circular reflectors and dome ports. Because it

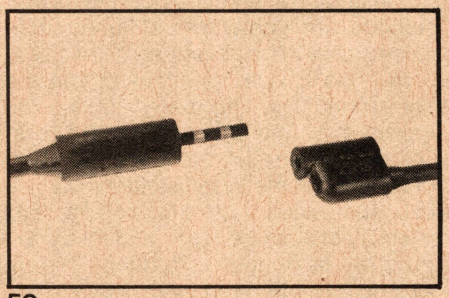


Subsea Products, Mark 225

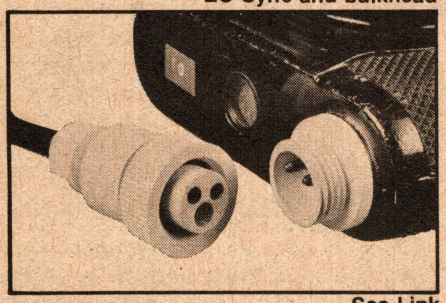
SUBMERSIBLE STROBES



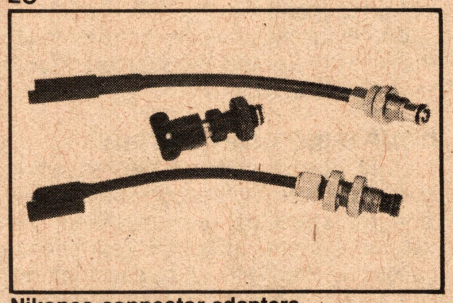
EO Sync and bulkhead



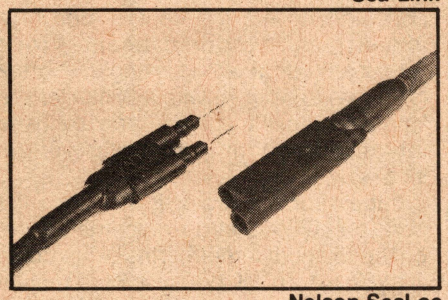
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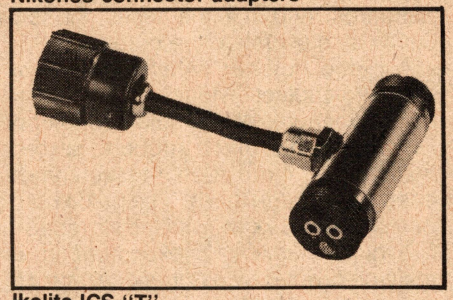
Sea Link



Nikonos connector adapters



Nelson SeaLoc



Ikelite ICS "T"

CONNECTORS

The connector is the fitting that attaches the sync cord to a Nikonos camera or camera housing.

Nikonos Connectors: Any connector that screws into a Nikonos flash socket is usually called a Nikonos connector, regardless of who manufactured it. When ordering a Nikonos connector, specify the model of the camera body. One type of Nikonos connector fits the Nikonos I and II; another type fits the Nikonos III and IV-A.

Nikonos Connector Adapters: If the sync cord has a different connector (such as a Nelson SeaLoc or EO connector), a Nikonos connector adapter must be used. It has a Nikonos connector at one end, and the other type of connector at the other end.

EO Connectors: Many strobe sync cords have EO (Electro Oceanic) connectors. These plug into Nikonos-to-EO connector adapters, or into EO bulkhead connectors on camera housings.

Nelson SeaLoc Connectors: Sometimes just called the SeaLoc, this connector has two separate prongs to separate the plus and minus terminals. These plug into Nikonos-to-SeaLoc connector adapters, or into SeaLoc bulkhead connectors on camera housings.

ICS (Ikelite Connector Systems) Connectors: The connector body is made of molded plastic, rather than molded rubber as with the EO and SeaLoc connectors. These are used with the Ikelite SST (solid-state triggering) system. These plug into special Ikelite bulkhead or Nikonos Power Pack adapters.

Sea Link Connectors: With a Nikonos, the male Sea Link module is permanently epoxied to the camera flash socket. Bulkhead and sync cord modules can be attached with hand tools. (Available from: Sea Research Bosco, P.O. Box 589, Bartow, FL 33830).

takes more power to spread light over a larger area, the larger wide-beam strobes may have a lower U/W guide number than smaller strobes which concentrate light into a smaller area.

SYNC/SLAVE MODES

A sync/slave strobe can be triggered two ways: (a) When the selector switch is set for sync mode, the strobe is triggered by the sync cord that connects it to the camera. (b) When the selector is set for the slave mode, the strobe is triggered by a slave sensor built into the strobe. This sensor triggers the strobe when it detects the flash of light from another strobe.

Some strobes are cordless slave models. These strobes don't have sync cords. Rather, they are intended for multiple lighting techniques when two or more strobes are used to light the subject.

MODELING LIGHTS

Some strobes have built-in modeling lights. The light serves three purposes: (a) It is useful for aiming the strobe, (b) can double as a dive light for night photography, and (c) can be used to help illuminate subjects for SLR focusing in dim conditions. While small, U/W lights can be attached to a strobe, a built-in modeling light is always there when you need it.

AUTOMATIC EXPOSURE CONTROL

When choosing an automatic exposure control, look for the following: (a) Can the remote sensor be aimed at the central picture area? If not, it may not give accurate readings. (b) Does the automatic control give you a satisfactory choice of apertures for the distances you will be using? For close-up work, for example, can you use f16 or f22? If not, you won't have much depth of field. In our opinion, automatic exposure control may give you a higher percentage of well-exposed pictures, but can be a hindrance to really creative lighting. Make sure that you can override the system if you wish!

ARMS, BARS AND BRACKETS

The arms, bars and brackets necessary to attach a strobe to a Nikonos or housed camera are usually priced separately. Because so many are available, it is beyond the scope of this article to show and discuss them.

REPAIRS AND WARRANTY

Before signing your check, ask where you take the strobe if it needs repairs, and how long will it take to get it back! Any strobe — regardless of who makes or sells it — can break down or possibly flood. Ask about the manufacturer's repair record. Note: The time required for repairs can vary greatly from time to time for any given company. The repair record may also be influenced by the dealer's aggressiveness and how much of the manufacturer's equipment he sells.

SDM travel SECTION

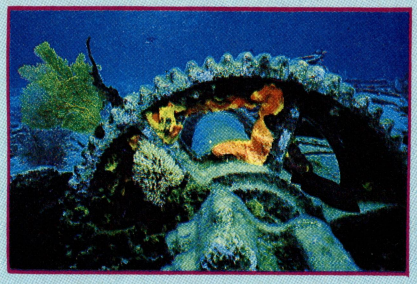
BAHAMAS' FAMOUS WRECK "FRASCATE"

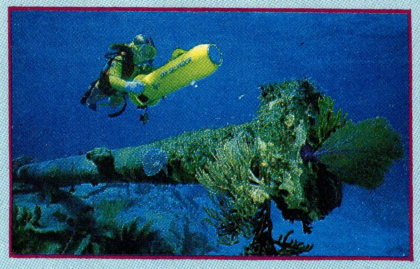
Text and Photography by Geri Murphy

One of the most photogenic shipwrecks in all of the Bahamas lies off the west side of San Salvador Island, less than a ten minute boat ride from a small diver's hotel called the Riding Rock Inn. An unusual combination of environmental conditions make this particular wreck ideal for underwater picture taking, thus, it is the most frequently photographed wreck on the dive resort circuit. The ship lies close to a drop-off and clean ocean water flows over its coral encrusted hulk with every tide. Underwater visibility averages more than 100 feet and often exceeds 120 feet. The ship lies in shallow, diveable water. There is so much ambient sunlight that camera lens settings are frequently f11 or f16.

The *Frascate* was a 261 foot steel hulled freighter traveling from New York to Jamaica, shortly after the turn of the century. Caught in a violent storm, the luckless cargo vessel was driven onto the shallow reefs of San Salvador Island in the winter of 1902. She was carrying a cargo of general goods. Years later, just prior to WW I, the hulk of this wreck was dynamited by scrap metal salvors who were after her precious brass and copper.

Today, the *Frascate* rests peacefully in less than 20 feet of clear blue water, covered with a fine veneer of coral. The dynamite pretty well leveled the ship's structure and her massive wreckage is spread out across five acres of ocean bottom. It looks as though some giant mysterious force has carefully disassembled the ship and provided the visiting diver with a fascinating picture puzzle. Just about all the major pieces are still there, but it takes time for most divers to figure out the identity of each part and how the ship fits together. What makes this task especially exciting is the superb underwater visibility. Upon entering the water, a diver can see just about all of the shipwreck from the surface.

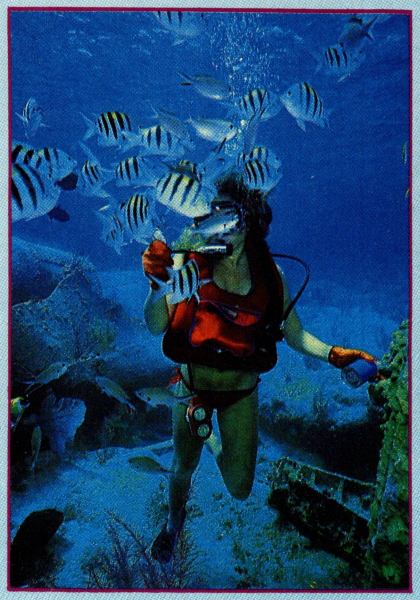




The sight is breathtaking!

Perhaps the most prominent feature of the *Frascate* is its twin giant steam boilers that sit side-by-side on the bottom. These massive metal drums are more than ten feet in diameter and approximately 20 feet long. Their insides are filled with a network of tubes, pipes and tunnels in which many fish hide. The boilers are so large a diver can actually swim through a tube which runs the full length of the structure.

Nearby, lies the massive steam engine block and next to that the rounded contours of a giant crank shaft. Both provide an opportunity for unusual wreck photos. From there, a long engine drive shaft runs back toward the ship's stern. It is broken away from the rear of the ship and juts outward from a coral ledge like a fallen telephone pole.



The ship's rudder and stern section are the most massive structures on this wreck, rising within five feet of the surface and providing an unusual opportunity to explore an inner portion of the hull.

Just a short swim from the stern brings the photographer to a piece of deck and ship's railing that is completely intact. It almost looks like a classic shipwreck scene from a Hollywood movie set and most divers find this portion a favorite for underwater pictures. Scattered in between these notable points of interest are such fascinating objects as: fallen masts; deck winches; bollards; hatches; a giant pile of anchor chain; and all sorts of ship's rigging. Each piece provides another clue to this ship's original design and one can begin to imagine how this vessel looked before it sank.

Completing the circular tour of the *Frascate,* a visiting diver encounters a large portion of the bow section loaded with a cargo of neatly stacked sacks of flour. Eighty years of saltwater submersion has transformed

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THE FRASCATE

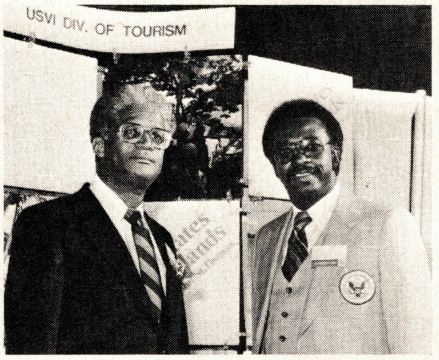
these bags into stony lumps.

In addition to the fascinating array of metal structures and the stunning underwater visibility, the *Frascate* is a haven for fish. A school of goatfish can be seen almost any day, quietly drifting back and forth across the wreckage. Individual snappers, groupers, trunkfish, squirrelfish, wrasse and other species inhabit just about every nook and cranny of this fascinating undersea junkyard. There is even a giant green moray eel to be found in one of the boilers.

The wreck of *Frascate* is a delight to all who visit and dive the waters of San Salvador. It serves as a cordial host to almost 1500 divers each year and yet seems none the worse for wear. It is the perfect underwater studio for both still photographers and movie makers who desire a romantic background for interesting pictures.

USVI TOURISM OFFICE

Amadeo I.D. Francis, commissioner of commerce for the U.S. Virgin Islands, has announced the opening of the West Coast sales office of the territory's Division of Tourism.



"Studies reveal that over 20 percent of our visitors now come from the Western states," Francis said. "We feel it is vital to have a presence here in order to further enhance the services needed by both travel agents and the vacationing public."

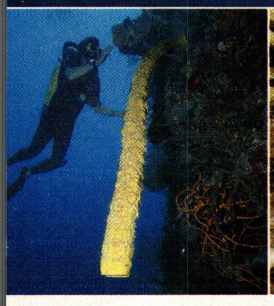
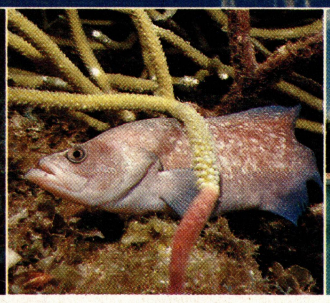
The office, at 3450 Wilshire Blvd., Suite 915, Los Angeles, CA, will be directed by Ludvig E. Harrigan, western regional manager. A veteran of 24 years in the travel industry, Harrigan previously headed the Miami and New York offices for the USVI Division of Tourism.

Harrigan points out, "The people in the West tend to take summer vacations instead of winter holidays. The U.S. Virgin Islands receive most of their visitors from the East Coast during the winter months. Thus, the West Coast visitor profile fits into our program almost to a 'T' since we can provide excellent rates in the summer, when the weather is just about as nice as in the winter . . ."



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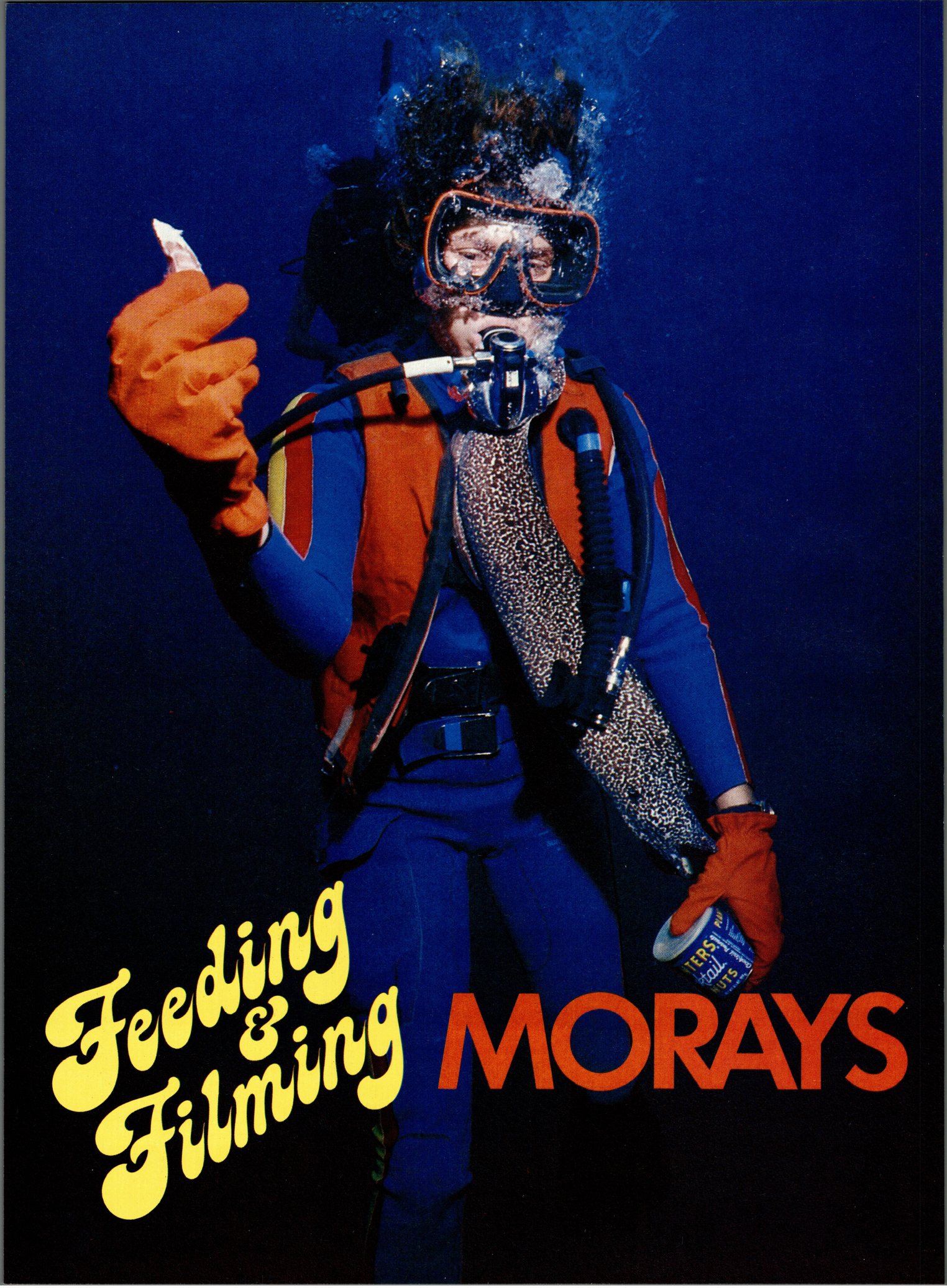

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Feeding & Filming
MORAYS

TAMING THOSE TIGERS OF THE UNDERSEA JUNGLE

By Paul Tzimoulis

There is no greater thrill in tropical waters than a diver's eyeball-to-eyeball encounter with a wild animal. Observing marine creatures at the near touching range can be a never ending source of fascination and entertainment. It can be a sweet little creature such as a shy angelfish or an impetuous grouper with an insatiable appetite. They are all marvelous entertainers and it is little wonder that fish feeding has become the number one underwater activity at most dive resorts around the world.

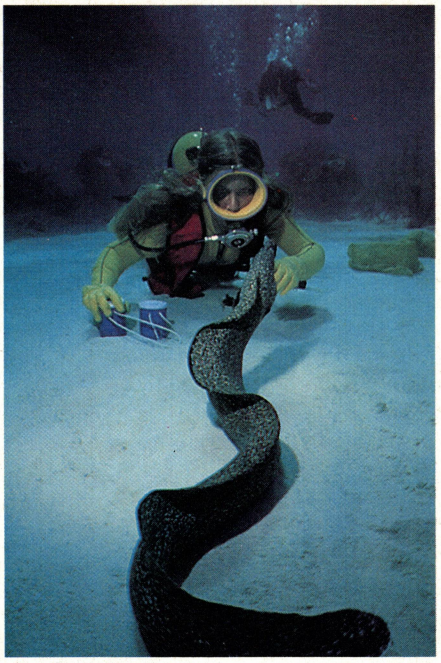
This special thrill of close encounters with undersea creatures can become especially exciting when they happen to have a reputation for ferocity. Characters such as the barracuda and stingray are publicly classified as "dangerous marine animals" and frequently listed as a diver's underwater enemies. Ranking high on this list of notorious animals, is of course, the moray eel: Indeed a formidable fish, but one of the most interesting creatures you will ever meet on an open coral reef.

My passion for hand feeding moray eels actually began with early attempts at photographing these elusive creatures. It occurred to me that a close-up of the moray's face, with mouth wide open and teeth flashing, would certainly be a prize. All I had to do was get close enough.

I soon discovered that getting close to a moray eel is no simple task. It is, in truth, a shy and retiring creature that spends most of its day hiding in a coral crevice or small cave with just the tip of its nose poking out into the open. As the diver approaches, the moray usually withdraws into the shadowed recesses of its protective lair, avoiding confrontation.

The appearance of a moray eel is far more frightening than its actual personality. It looks scary because it usually has its mouth open; the jaw is slack, revealing several rows of gleaming white teeth. This stance is not a demonstration of hostility (as with a dog or tiger), but the way in which the eel breathes. A moray must take in great quantities of sea water through the mouth and pass it out through the gill vents at the rear of the head. This regular flow of oxygen-bearing water allows the moray to breathe in somewhat the same way humans inhale and exhale air.

My close-up observations of moray eel behavior soon revealed that an offering of food would probably be the only way I could obtain the photo I desired. The first feeding event was purely an accidental encounter. I was actually coaxing a small grouper close to the camera lens when a moray suddenly appeared in its place. The presence of small chunks of chopped mullet had obviously lured this small moray from its hiding place. Much to my surprise and delight, the moray behaved extremely well, politely waiting for its turn to be fed and never once exhibiting any aggressiveness toward its apprehensive feeder.



photo/Paul J. Tzimoulis

Left, dive model Donna Schnabel coaxes Cleopatra from her coral home at Snapshot Reef, San Salvador, Bahamas.
Below, eels sometimes pay more attention to the diver than to the snack offered.



photo/Geri Murphy

It was not long before my moray eel photography was pre-empted by an even greater love — moray eel feeding. I would continue feeding these graceful creatures long after my camera had run out of film. The moray is a creature of hypnotic beauty and sensual movement. I spent hours just watching its amazing fluid mobility and precise control. Half-floating and half-undulating, the moray virtually ripples its way across the reef, deftly dodging the thorny spines of sea urchins and the razor sharp edges of coral formations.

I also discovered that the moray is a fussy eater with a very specific marine munchie diet. It will turn up its nose at chopped conch and totally ignore sea urchin insides. Instead, moray eels prefer to dine on small chunks of baitfish, fish fillets or even a bit of lobster meat. This creature is no cheap date! The best food offerings are some of the more common fishing baits such as: ballyhoo, mullet, silversides, or pilchards. Once I even tried frozen squid and was somewhat overwhelmed by the moray's enthusiasm for this delicacy. I also discovered morays cannot be overfed, as can their hogish neighbors, the grouper. Most morays cease feeding once their hunger has been satisfied and no amount of coaxing will convince them to come back out of their hiding places and resume feeding.

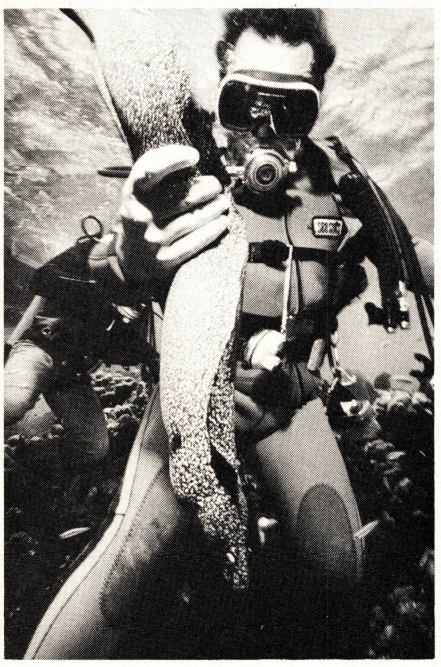
Why this obsession with feeding morays? Perhaps it is the thrill of establishing a brief communication link with a totally wild animal. I guess it is the same reason tourists drive thousands of miles to Yellowstone Park just to feed the bears. Somehow, you feel relatively safe in being the provider of food, knowing full well that the moray is a wild animal with a dangerous set of dentures. The most impressive lesson I learned during these feeding sessions is that fooling around with morays can result in a lot more than a diver had bargained for.

Divemaster Dee Scarr, of the Flamingo Beach Hotel, tries to lure an overly friendly moray (named Benedict Arnold) away from her BC. Benedict lives at South Bay Reef, off Klein Bonaire, Dutch Antilles.

photo/Geri Murphy

One of my most memorable encounters with a moray eel was Cleopatra, a little three and one-half foot black and white spotted moray with a really sweet disposition. We were diving on Snapshot Reef off San Salvador Island, Bahamas and engaged in a grouper feeding session at 15 feet. My model was Donna Schnabel, a lady well practiced at the art of fish feeding and skilled at posing with the Nassau groupers who lived on this reef.

We had been feeding and photographing the groupers for over 15 minutes and the scent of the generously distributed fish food had pretty well permeated several of the coral heads within our immediate area. I was halfway through the film in my first camera when I suddenly noticed the appearance of a small black and white moray eel on a coral head ten feet away. The inquisitive eel was stretched halfway out of its crevice with its nose pointed directly at the source of our fish food like a bird dog on point. I hand signaled to Donna that we should move closer to the coral head and attempt feeding the eel.



Before we could change position, the eel decided to come to us. It slipped gracefully out of the coral head, swam slowly to the sandy bottom and began to zig zag its way toward Donna. It was obvious that this eel was totally unafraid of divers and now in the process of tracking down the source of the enticing food scent.

From the beginning, Donna and I sensed that we could trust Cleopatra. Her slow and casual movement seemed to project a special gentleness, uncharacteristic for moray eels. Perhaps her comparatively small size added to our confidence.

Cleo swam right up to Donna, curling around the closed food can and gently nuzzling her arm, shoulder and hands. The little eel was as gentle as a kitten — and just about as friendly. In fact, Donna soon found she could actually pet the eel, stroking its sides as it swam back and forth in search of food. I was absolutely ecstatic as I blazed away with camera and strobe. Rarely does an underwater photographer have an opportunity to document eel and diver out in the open.

Just about the time I moved in close (two feet) for a tight frame shot, the eel seemed to lose interest in Donna and began swimming toward my flashing strobe. All that I could see through the viewfinder was the head of an oncoming eel undulating across the bottom with its mouth wide open. This view of the business end of a moray is indeed enough to make your hair stand on end, but for some absurd reason I felt safe behind my little Nikonos camera.

Then the eel disappeared from my view and all was calm. At first I thought it had gone past me, but Donna's wide-eyed look of horror told me otherwise. The next thing I felt was the soft silky touch of moray eel skin against my jugular. That crazy eel had coiled its body completely around my neck like some undersea boa constrictor. The eel was now nestled between my neck and the collar of my wetsuit jacket. Its head was barely inches away from my mask as it casually bit into the air bubbles exhausting from my regulator mouthpiece.

A torrent of wild and crazy thoughts raced through my mind as the eel continued to wiggle and nuzzle against my body. I remained perfectly still, more out of shock than good sense. Tiring of her newly assumed position, the eel gracefully slid off my neck and began to wind her way between my BC jacket and wetsuit. Next, it coiled around my regulator hose and began nosing around the viewfinder of my camera. Now I could finally see the head of the eel out of the corner of my eye. All that I could think was that this nutty animal had mistaken my body for the safety of a coral head. The obvious solution to my dilemma was to remain motionless and pretend to be a coral reef until the eel decided to move on. The eel and I played this cozy game for a minute or two, although it seemed as if this heart pounding encounter went on for hours.

By this time, Donna had regained her composure and enticed the eel away from my head by opening the food can. The flowing scent of fresh fish food quickly drifted toward the eel's nostrils and Cleo departed my body as smoothly as she had arrived.

Not all encounters with morays go as smoothly as the one with Cleopatra. The moray eel is a wild animal, much like a tiger or bear. Its behavior is, therefore, unpredictable. Anyone who feeds or fools around with eels can expect to get bitten sooner or later. No matter how careful you are, or how gentle the eel, the risk still exists.

The bite of a moray eel is seldom intentional, but instead a case of mistaken identity. Most morays have poor eyesight, particularly as they grow older. These eels generally locate their food by a combination of smell (or taste) and by the detection of sudden movement. The swirling scent of fish food or the sudden shift of a diver's hand can easily confuse this half-blind creature, thus causing it to strike out instinctively. In most cases the strike is a reflex action rather than a premeditated bite.

A good example of this mistaken identity was my surprise encounter with Benedict Arnold, a moray eel so named because it has a habit of biting the hand that feeds it. I was diving on a reef known as South Bay, off Klein Bonaire, when this particular incident occurred. Divemaster Dee Scarr was leading a group of 14 divers on tour of the reef when she encountered a semi-tame four foot long black and white spotted moray. The eel was so eager for food that it left the safety of the coral reef and greeted her in open water at a depth of 50 feet.

Below, divemaster Garth Easton hand feeds Cleopatra while a school of bluehead wrasse gathers for leftovers. Left, Garth caresses Cleo as she gracefully glides by in search of more tidbits. Cleopatra showed no fear of divers and repeatedly allowed such contact.



photos/Paul Tzimoulis



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MORAY FEEDING

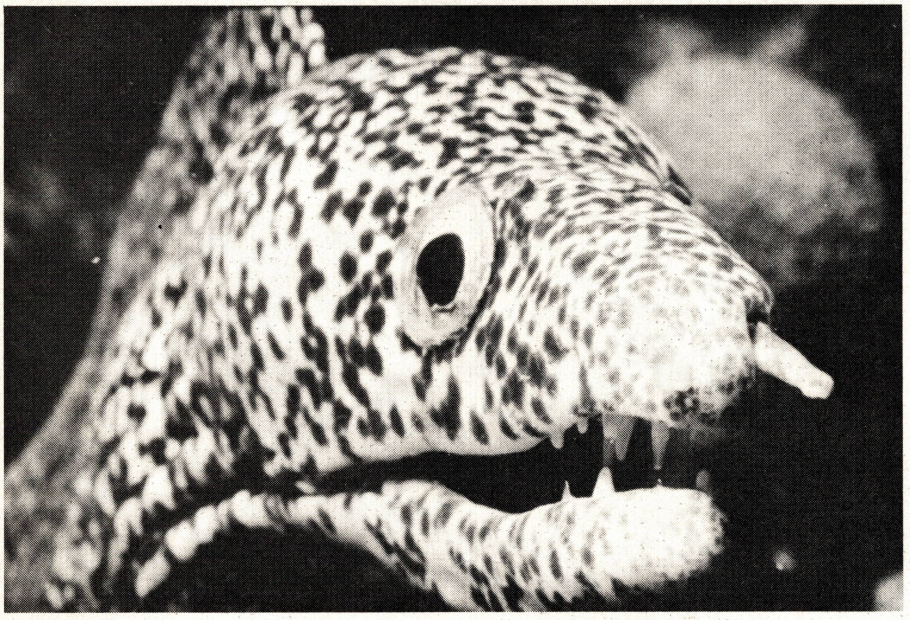
I quickly moved in to document this unusual feeding behavior, as Dee and the moray eel swirled about in an almost acrobatic dance. Unlike Cleopatra, this moray appeared extremely aggressive. It swam quickly up and down Dee's body. At one point, the eel curled around Dee's neck and then spiraled down her arm in search of food. It was obviously excited, but Dee seemed to have the situation well under control.

Then the inevitable happened. The moray left Dee's side and swam straight for my camera lens! Once again I found myself in the compromising position of having an excited moray eel coiled around my neck. Having experienced this identical situation only months before, I felt a little more confident about the moray temporarily wrapped around my body. Looking back, I can now see that this was my first mistake. One should never trust a moray eel—especially if it is clinging to your scuba gear.

Remaining as motionless as possible, I drifted slowly toward the slope of the reef where I could gain a solid footing for better control. I was also hoping this eel would hop off my body when a convenient coral head came into view. Everything was progressing as planned when I discovered that I had landed next to a can of fish food. This was my second mistake and the one which eventually led to my downfall.

The invisible but delicious scent of fish food juices drifted past my shoulder and quickly found its way to the alert eel. Not

A sudden face-to-face encounter with a moray can be an unnerving experience. Cleopatra's display of sharp teeth appears fierce but actually this is the typical moray resting pose.



photo/Geri Murphy

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thinking too clearly, I made the classic error of reaching out with my right hand in an attempt to move the food can away from the eel and myself. Unfortunately, I was not wearing gloves at the time. The enticing combination of fresh fish scent, bare white fingers, and a quick hand movement were just too much for the eel to ignore. The moray gracefully slid off my left shoulder, swam in front of my facemask and casually clamped down on my right thumb. The entire sequence seemed to happen in slow motion and I can remember saying to myself, "This can't really be happening." The moray's pointed teeth sank deep into the flesh at the base of my thumb with the ease of a hypodermic needle. A total of eight teeth pierced the topside of the thumb while two others sliced into the underside. The bite felt like a small electrical shock, and the moray quickly released its grip. I was amazed to see this entire event taking place less than 20 inches from my facemask.

It was obvious to me that the moray eel had made a mistake and quickly realized its error. Apparently, humans do not taste anything like fish fillets and the eel released its grip in a split second. Then it continued on its way, searching for real food. Meanwhile, I sat there stunned. I found it incomprehensible that an eel could do such a thing. Somehow, I had actually come to believe that my experience and skill at eel feeding had made me immune to such an attack. Was I wrong! Moray eels, like any other wild creature, do not develop any particular bond of friendship or love for the hand that feeds them. Morays merely cavort with humans because of the food which eventually results from such encounter.

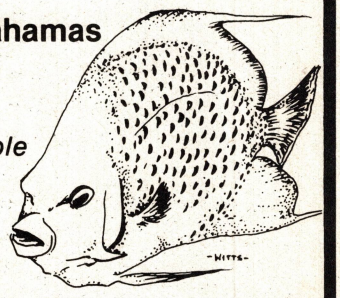
There is however a happy ending to this episode. Contrary to the rumors you may have heard, moray eel bites are not poisonous. While their teeth may resemble the fangs of a snake, morays carry no toxic substance. In fact, moray eel bites are seldom infectious. My wound was simply cleaned with hydrogen peroxide, dressed with antibiotic cream and covered with a band-aid. The wound healed quickly and without much discomfort.

Looking back on these unusual moray encounters, I must confess I would do it again. My passion for eel feeding and filming has not diminished one iota. The only difference is that I now approach moray eels with a realization that I may indeed be bitten. It is a risk I am willing to take, but not one universally shared by my diving companions.

If there is a lesson to be learned by these encounters, it is that moray eels are wild animals and should be treated accordingly. Don't fool yourself into thinking that these lovely creatures can be totally tamed. They do not behave like domesticated cats or dogs, but instead possess the basic survival instincts of the coral jungle.

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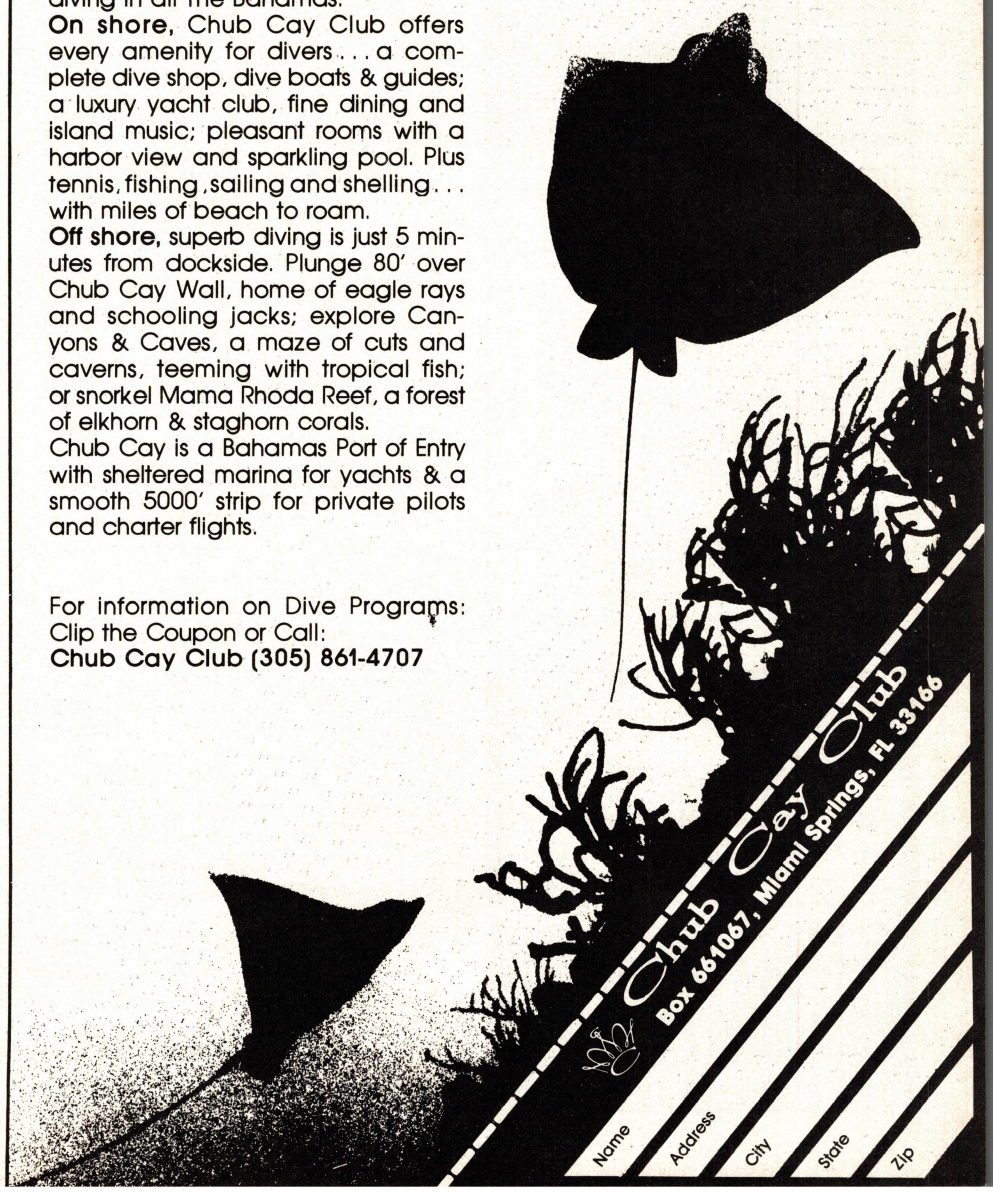
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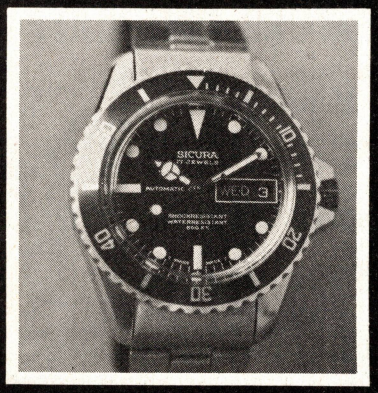
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SAN SALVADOR PRINTS COLOR

Dave Woodward, manager of the Underwater Photo Center, recently announced a new photographic lab service available on San Salvador Island, the Bahamas. The Photo Center has installed complete enlarging and color print facilities. Pictures can be printed while you are out diving.

Woodward reports that he is utilizing the Cibachrome color print process, considered one of the finest available today. Prints are available in three basic sizes: 8x10, 11x14 and 16x20.

The new color print service is available for underwater photographers, non-photographers, and non-divers as well. Underwater photographers visiting San Salvador can have prints made of their own pictures. Non-photographers or non-divers can order color prints from a selection of high quality underwater photographs taken by Dave Woodward and other San Salvador professionals. Visitors can browse through a large album of underwater photos to pick out exactly what they would like. They can also choose photos from one of the several underwater slide shows which are given at the Riding Rock Inn on a weekly basis.

The underwater color print service is already popular on San Salvador. The professional quality photographs provide a perfect display for visiting diver's living rooms, dens and offices. These prints also make excellent gifts for family and friends.

Other photographic services available on San Salvador include: daily E-6 processing of all Kodak Ektachrome film and Fujichrome film, underwater camera and strobe rentals, underwater photography classes (both one day and two day courses), underwater photo coaching, underwater photographic equipment repairs and advanced, one-week, underwater photo courses. San Salvador is a popular vacation resort, catering to approximately 2000 visiting divers annually.

You can obtain brochures on all of the Underwater Photo Center's services and underwater photographic courses by writing to: Columbus Landings Service Company, Inc., P.O. Box 1492, Ft. Lauderdale, FL 33302. Should you want this information immediately, telephone U.S. toll free (800) 327-9473. Florida and Canada residents call (305) 566-7444.

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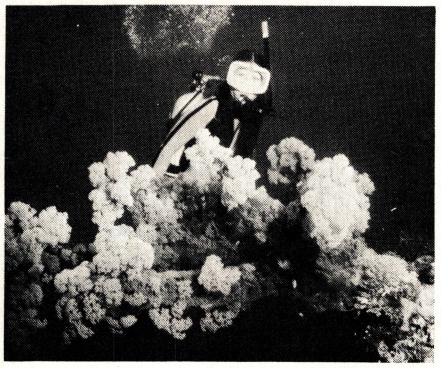
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Single occupancy supplement is $79. Third person in same room may deduct $38 from price of package. Price of tour for non-diver sharing diver's room is $369 MAP. Price for child under 12 years sharing parents' room is $289 MAP. Air transportation is additional.

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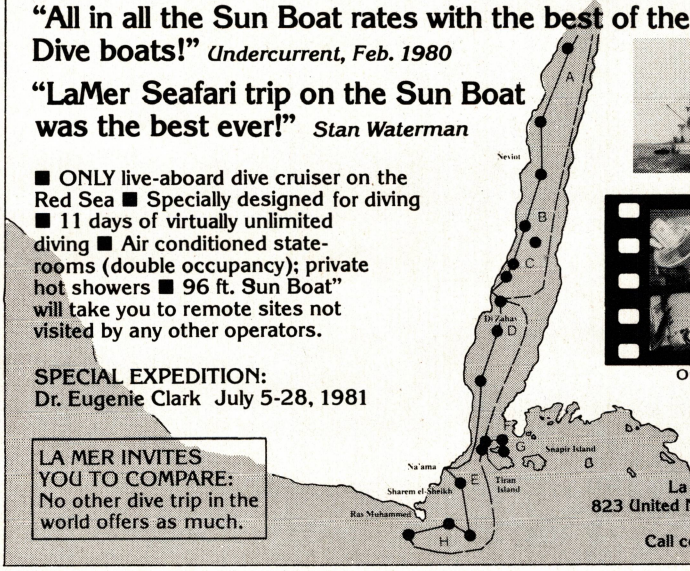
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GLAMOROUS High Pay Photo Job In The Tropics?

Text and Photography By Al Hornsby



Between shots, Melanie Vincz makes the difficult exchange from regulator to snorkel.

On Thursday, I received a call from a large Los Angeles ad agency that I had done photography work for in the past: "We're putting together a billboard campaign for one of the major airlines. We've envisioned an underwater shot — an attractive girl snorkeler relating to a group of fish. The idea is to, Meet the Natives, by flying the airline to the tropics. The photograph needs to be bright and colorful, the fish and the girl very directly involved with each other, and the quality good enough so we can blow it up to 14 by 40 foot billboard size. Can you do it?"

"Of course."

After hanging up the telephone, I ran a quick checklist in my mind: location — San Salvador, first choice — tame, cooperative fish, excellent support staff and facilities, photo lab for immediate film processing, and clear, calm water even though it is mid-winter.

Model — Melanie Vincz, popular television actress and underwater stunt diver, first choice. She had been my model for numerous other underwater and topside photographic projects over the last few years. A PADI advanced open water diver with dive experience around the world, she is totally professional.

Costs — transportation, lodging, film



Dive San Salvador

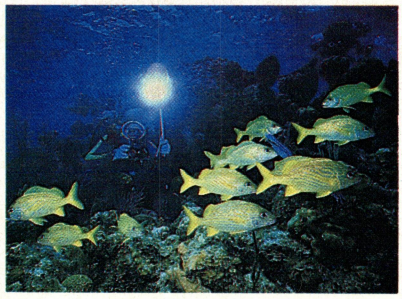
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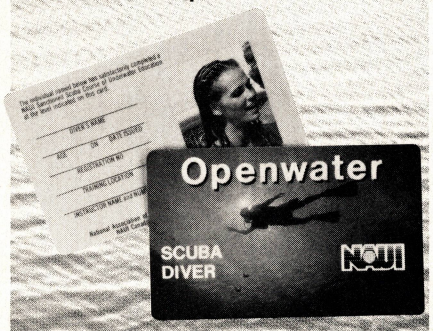
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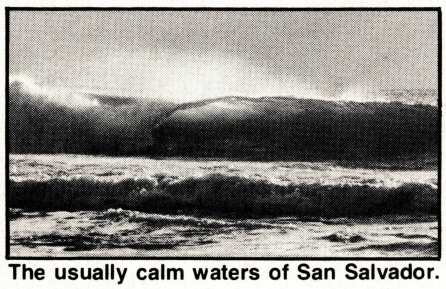
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GLAMOROUS PHOTO JOB

expenses, boat and captain, support diver, photographer and modeling fees (Melanie earns about $500 per day for such jobs) and incidentals.

A quick visit to the ad agency where budget and timetable are presented (and approved), art layout provided, and we are on our way. We would make a Friday night red-eye flight from L.A. to



The usually calm waters of San Salvador.

Miami with connections to San Salvador on Saturday morning. The support arrangements would be organized that afternoon, the shooting would take place Sunday, film would be processed Sunday evening.

Yes, we do live in a jet age dream world, with the pleasures of diving the beautiful tropics on an exciting job at high pay, all within a few hours of a simple telephone call. Aah, sounds great, doesn't it? Couldn't imagine anything easier, anything more comfortable, anything more pleasant, right? Right?

Wrong!

Now, it has been said that San Salvador Island is located in some sort of rare, weatherless air-pocket which the gods have blessed.

However, it seems good ole Murphy (of Murphy's Law fame), that universal purveyor of mistake and misfortune, can trip up even the most reliable constants man has ever been able to discover, deduce, or pray for. There was something about the rain-swept, 50 mph weather front we battled on the flight to San Sal that should have hinted this was to be one of Murphy's command performances.

Upon arrival in San Salavdor, we met with Dave Woodward, resident professional photographer, and outlined our plans. Dave agreed to act as our support diver and arranged for Archie, one of the island's best-known boat captains, to provide our ocean transportation.

Due to the exaggerated horizontal format used on billboards, the photograph had to fit a reasonably exact layout. The bikini-clad snorkeler and the school of fish had to be correctly placed, all suspended just below the surface. In San Sal, shallow, clear (and very calm)

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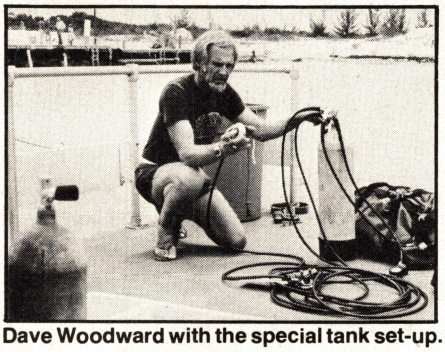
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water complete with numerous tame, easily photographed fish means one well-known location — Snapshot Reef.

The plan was relatively simple: we anchor in 15 feet of water and move to a spot with coral near the surface in the six to ten foot depth range. Dave and I would go under and while I was setting up cameras, he would begin fish feeding. After attracting a large group of the friendly critters, Melanie would enter the water and begin shallow free dives, hovering just over the coral head, one hand reaching to the fish, her fins gracefully extended behind. By stuffing hot dogs into the coral crevices, we intended to keep the mass of fish in the desired location. Dave would maintain the feeding and aim my third slave strobe as a rim light; I would shoot and manage my main strobe and slave. After a roll of film, we would allow Melanie to warm up in the boat, then we would repeat. It seemed that three rolls of film would guarantee adequate coverage. It all seemed easy enough.

Now, even though we knew bad weather might be on the way, San Salvador was still holding fine. The water at Snapshot Reef was like a sheet of glass, gin-clear, and fitting all the other popular descriptive phrases we have read so many times. It looked as if the next morning might still bring that perfect shot that fills every photographer's dreams.



Dave Woodward with the special tank set-up.

Well, I did mention Murphy a little earlier in this story. The next morning held his unpleasant surprise — winds gusting to 40 mph, six foot breakers on Snapshot Reef, 55°F air temperature, and a cold, drenching rain.

The show, however, must go on. After a conference, we gathered an extra piece of gear that might be required to complete the assignment — a tank and regulator with the second stage attached to a 30 foot hose.

Since our original choice location was now a vicious surfline, we had to work deeper, about 25 feet under. Rapidly deteriorating conditions and a chilling, rain-cooled surface water temperature of 70° told us we were indeed to earn our money — there were to be no picnics on this trip!

(Continued on Page 91)

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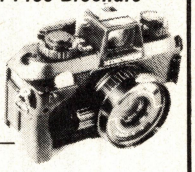
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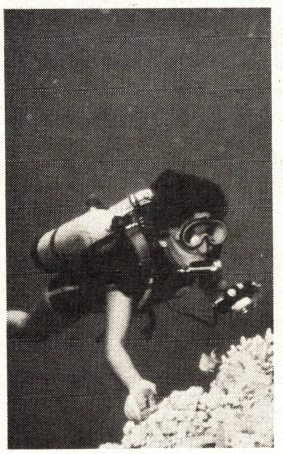
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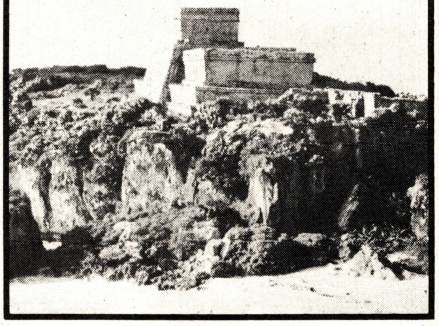
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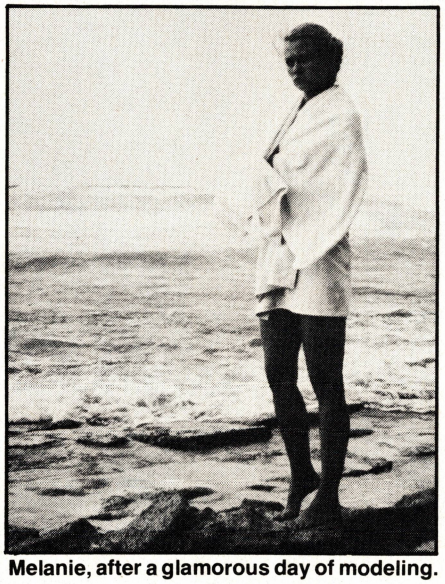
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GLAMOROUS PHOTO JOB

(Continued from Page 87)

Visiblity became worse by the minute. I set up my gear to maximize handling speed, depth of field and to minimize camera to subject distance. Armed with a motorized Nikon F2 with Nikkor f3.5 16mm lens in a Farallon/Oceanic housing, Dave and I jumped in and began preparations.

The waves passing overhead had already begun to sweep the bottom, stirring up the sand. Because of the extremely rough surface, a snorkeling shot had become impossible. As we had feared, it would be necessary to attempt the photograph in a more difficult manner. Melanie would be forced to remain on the bottom, alternately breathing from the extra tank we had brought, then posing as a snorkeler. My shot would have to



Melanie, after a glamorous day of modeling.

be brightly lit to appear near the surface and the background could not reveal the true depth of the water.

Only because of the assistance of Dave, an experienced instructor, maintaining a position within arm's reach of Melanie, and her proficiency as a stunt diver, would we attempt such a dangerous shot. It is not intended that the lighthearted approach to this story should reduce the serious nature of the skills required for this sort of underwater activity.

After Dave and I had concealed the extra tank and coaxed the fish into position, I returned to the surface for Melanie. As she entered the water, the boat was pitching and straining at the anchor line in the foaming swell. Since Melanie could not wear a wetsuit, she was cold from the onset. We descended, with Melanie breathing on my extra second stage until she could transfer to the tank and regulator at the bottom. She had already begun

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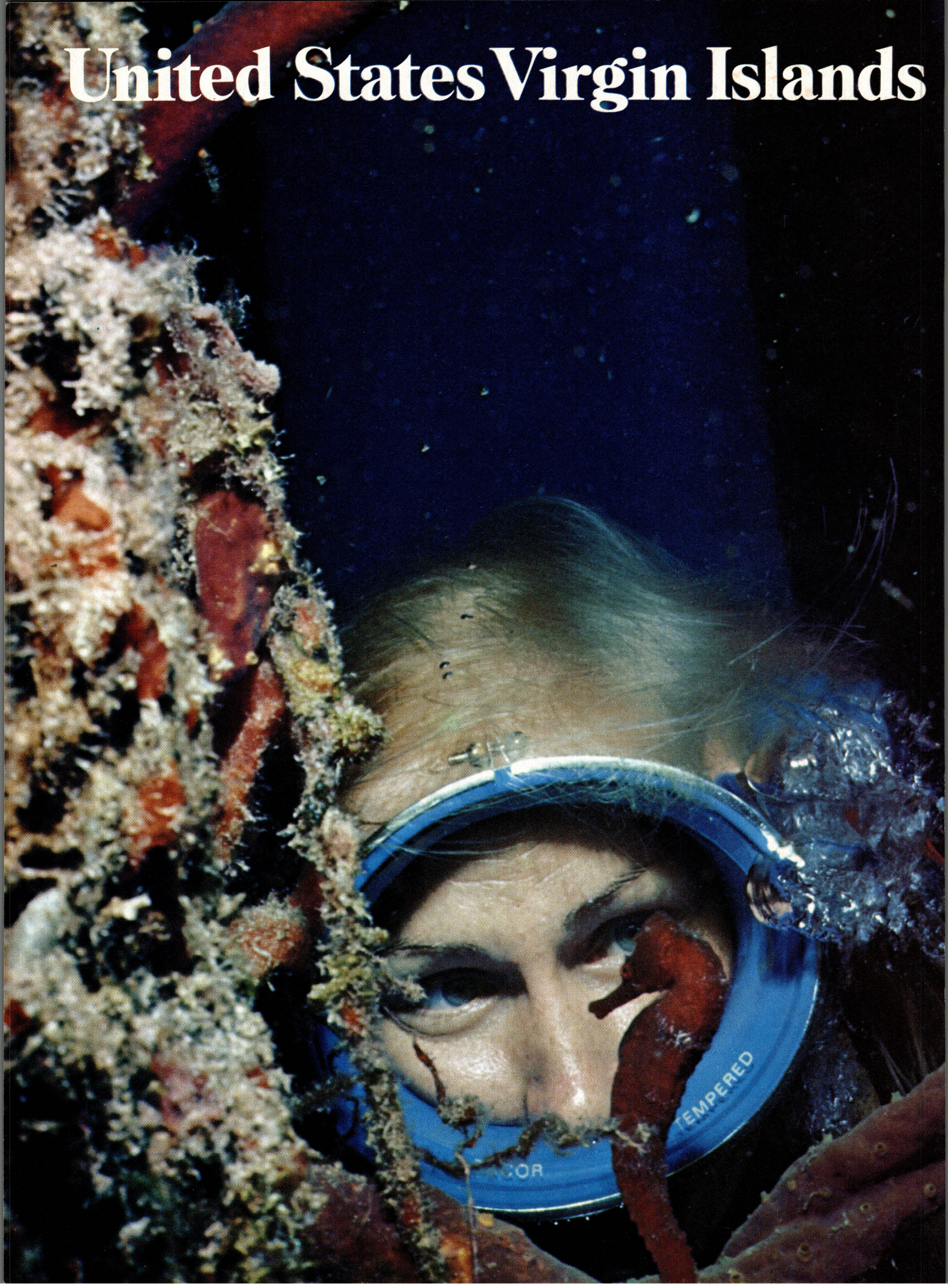
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GLAMOROUS PHOTO JOB

to shiver, so we knew we had to work as quickly as possible. It was necessary to weight Melanie to keep her from being too buoyant, but since no weightbelt could be used in the shot, she had to hide a six pound weight in her bikini bottoms.

I weighted myself heavily to avoid being bounced around in the surge, and Melanie held tightly to a coral head. The sequence of her taking out the regulator, putting in her snorkel, hiding regulator, posing in a relaxed manner with the fish, then getting the regulator back, all while being swept back and forth over the rough bottom, went on for a cold, torturous 40 minutes. As Melanie's shivering increased, it became noticeably difficult for her to get the mouthpieces through her clenched teeth, and breathholding was becoming harder. Dave and I kept an anxious eye on her, especially as it became apparent she was swallowing water during the exchanges.

As soon as my film was gone, I rushed Melanie to the surface and into the boat.

I'll tell you, there are very few things more nervewracking than feeling an important photography assignment going down the tubes. That evening, waiting for Dave to finish processing my single roll of film in the resort's custom photo lab, the decision I was trying to make was not whether or not to resort to suicide, but just how I was going to accomplish it! Between the roughness of the water, the poor visiblity, the lack of sunshine, the horrendous working conditions, and the fact that we only got one roll of film, it seemed very doubtful we would manage to satisfy our client.

Do stories have happy endings? I am pleased to say, indeed, some do. We did get the shot; in fact, several. The agency was pleased, the client was satisfied and the billboards have gone up.

But, next time you see an underwater catalogue, ad shot, or film, and wish you were one of those lucky folks getting paid for simply having fun, well, maybe it will seem a little different after this brief glimpse behind the scenes.

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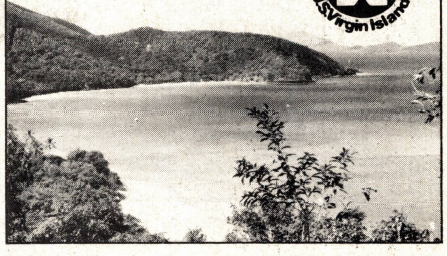
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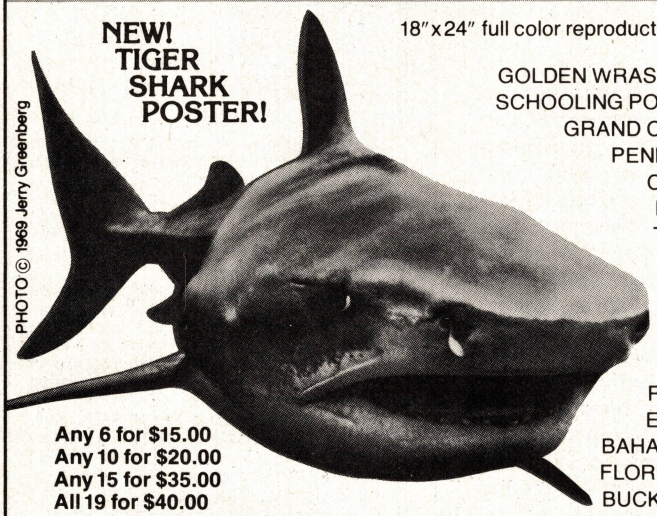
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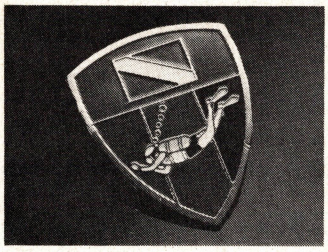
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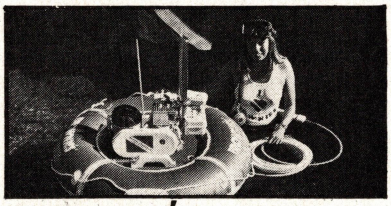
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IKELITE

(Continued from Page 39)

we will have several new accessories for the Nikonos IV-A.

SDM: Does Ikelite do anything formally to encourage underwater photographic education?

LIVERS: We have not done a great deal in the past. We do recommend U/W photo courses to our customers and to the public during various presentations. We plan to become much more involved with information and education services especially for our dealers. I have already mentioned the small books we will be doing. The first one will be on the 110 system. The next will probably be on our strobe and our SLR system — right on through to movies. We will probably have about five books when we're through.

SDM: Do you have any recommendations or opinions on the content of underwater photo courses?

LIVERS: Sometimes I think that they create a little confusion by not explaining the differences between the Nikonos and the SLR system well enough. It seems as if it is either one or the other that is the answer when, as you and I know, it is both. They both do a certain job and sometimes one does that job better than the other. For certain kinds of underwater photography and for really critical focusing and framing, there is a preference for the SLR in a housing. As far as money, they cost about the same, so I think we really need to explain the differences a little better.

SDM: Do you have any personal thoughts on the underwater photography market in terms of trends or directions?

LIVERS: I think more specialized equipment will continue to become available as the market grows.

Ten to fifteen years ago, when Ike first started, the main objective was to get the camera underwater and keep it dry. People didn't look very closely at picture quality, they were fascinated because it was an U/W photograph. Today that has changed. We know we can keep the camera dry, now the important thing is what provides the best picture. Through written material and photo courses, today's U/W photographers can learn what equipment will do the best job for them. As they become more knowledgeable the equipment will become more specialized.

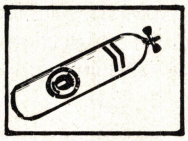


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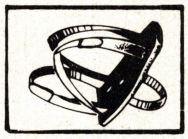
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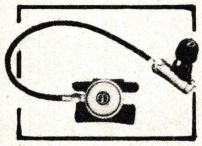
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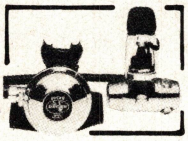
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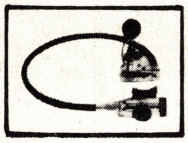
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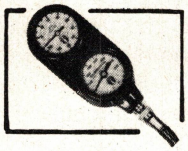
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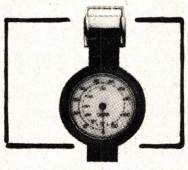
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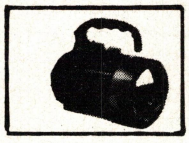
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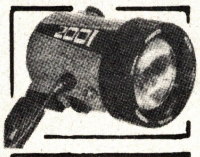
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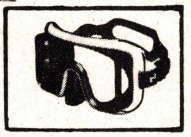
TEKNA MAX DEPTH
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$59. TEKNA DEPTH
$45. FARALLON DEPTH



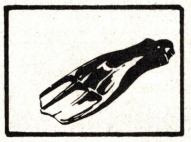
OCEAN PRO LIGHT
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$76. OCEAN PRO LIGHT



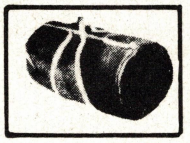
2001 STROBE
Farallon/Ocean pro model. Rechargeable wide angle with E/O; Nik II; Nik III. List $550.
$419. 2001 STROBE



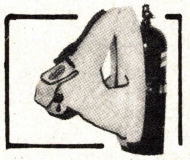
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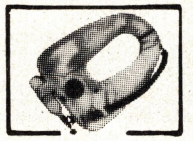
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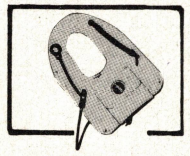
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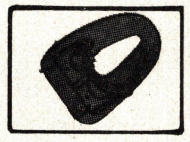
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43 or 55 Lb. stabilizing B.C. complete with low pressure inflator, CO_2, Kam Pac, etc. List $259.
$159. SEA OTTER
$189. DELUXE STABILIZER



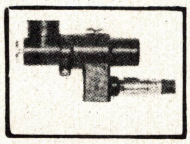
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$179. NEMROD AIR B.C.



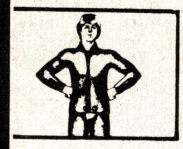
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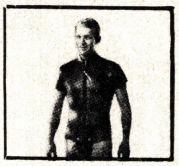
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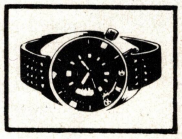
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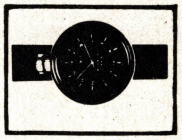
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Sharkskin type, nylon lined, stitched seams. Waist high, 5 zipper 1/4" or 3/16". List to $138.
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$109. 1/4" NYLON 1



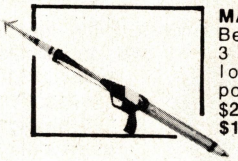
TUNIC
Short sleeve zip jacket, with crotch flap. Taped seams, colorful, mens or ladies. List $70.
$49. TUNIC



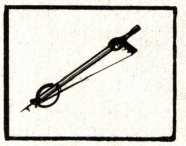
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$129. SEIKO WATCH



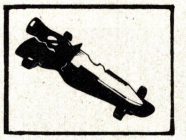
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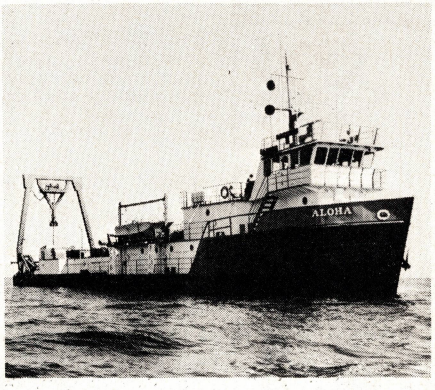
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SUBMERSIBLE RECOVERS

Five environmental impact arrays lost in the Baltimore Canyon were recovered last summer by the International Underwater Contractors' *Mermaid II*, a 1000 foot submersible. The submersible was carried aboard the 143 foot support vessel, *Aloha*. The successful completion of this work enabled VIMS to complete its environmental studies for BLM.



After sea trials with a mock-up indicated that sonar search and the above described retrieval maneuvers might in fact be successful, Virginia Institute of Marine Sciences (VIMS) and IUC began offshore operations. In the planned seven days at sea, five arrays were located and retrieved.

Since the completion of this job, the *Aloha* has been outfitted with a bow thruster, plus an 18 ton hydraulic crane for handling an RCV or diving bell.

The *Aloha*, with IUC's submersible, is now based in the Gulf of Mexico.

SCUBA BARBADOS TOURS

BWIA International is promoting new eight day/seven night Scuba Barbados dive tours to Barbados in the eastern Caribbean until Dec. 15.

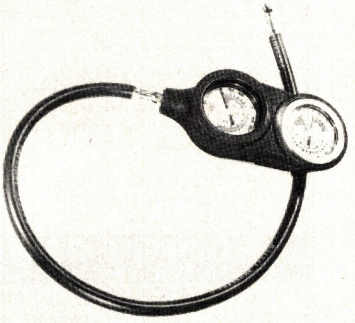
Priced at $539 MAP per person, double occupancy, the tour includes accommodations at Barbados Beach Village, round trip airport transfers, breakfast and dinner daily, welcome drink, and 12 dives — including boat, guide, use of tanks and weights, and unlimited air fills.

The wreck of the *Stavronikita* is only seven minutes from shore and numerous reefs teeming with marine life are nearby in waters 12 to 150 feet deep.

For more information, contact any travel agent, BWIA International, or the tour operator, Weekends Away Travel, 6015 Garfield Street, Hollywood, FL 33021, telephone toll-free (800) 327-9543; in Florida (305) 983-8434; in Dade County (305) 625-0734.

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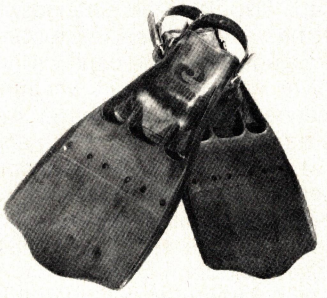
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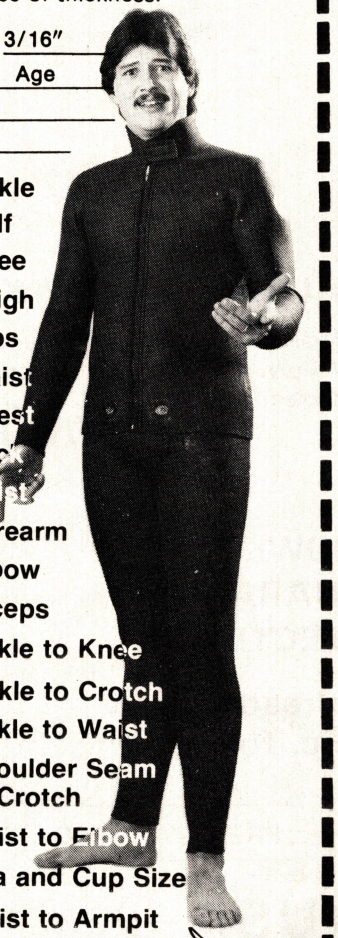
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TECHNIFACTS

(Continued from Page 40)

Divers may be employed by a boat owner to make an underwater hull inspection as a result of grounding, striking a submerged object, or as a result of collision with another boat or dock. Usually no special equipment is required. An underwater slate (or Ascot paper) for note taking, and a steel measuring tape should be carried.

Before beginning work of any kind around propellers or rudders of boats it is advisable to shut down the engine so the propeller cannot be accidentally turned. Also, lash the steering wheel (if boat has a wheel) so the rudder can't be moved. These precautions apply to all diver work on all boats whether or not someone is aboard the vessel. A rudder can be moved violently back and forth by wave action. There is seldom little clearance between a rudder and various fittings on the hull. A diver's hand, arm, or leg could be seriously injured by a whipping rudder.

Gross damage to a boat hull that results from grounding or collision with some object will be readily apparent to a diver. Such damage should be measured and sketched. In vessels that have been grounded, the keel, bottom of the hull, skeg, propeller and rudder are the main areas to inspect.

A diver who has made himself familiar with the construction methods and materials of boats can also assist in making an internal inspection to determine if there has been damage not apparent from the outside. This could be: the hull having separated from frames; planking (in wooden hulls) spread apart; cracks in framing; and in fiberglass or metal hulls, cracks or bulges.

Propellers should be checked for cuts or dents in the blade and the shaft checked for alignment. Check shaft bearings for damage and for any wear in the shaft log. If the shaft appears or feels loose there is probably damage.

A frequent problem in small boat operation is fouled propellers. A commercial diver's chest of tools should include the necessary tools for cleaning these. A sharp knife and a short bladed hacksaw, with lots of spare blades, are musts. A hacksaw is necessary to cut wire rope from a propeller as well as for cutting larger sized fiber ropes (manila, sisal, hemp) or artificial such as polypropylene, etc. Pry bars may be required to loosen the tightly wrapped turns from the shaft and propeller after they've been cut.

In making underwater inspections of sail boats having outside ballast, carefully check the point where the ballast is attached to the hull to determine if there is damage to the ballast bolts or to the surrounding timbers. Another point

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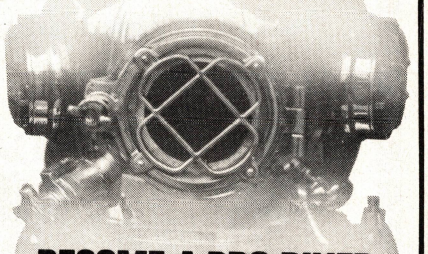
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to check is the underwater planking. Excessive strain on the hull will be indicated by cracked paint along the seams of planked boats, possibly to an extent that caulking will be observed. Another place to check on a sail boat is the hull in the vicinity of the chain plates. Usually grounding, or collision, places excessive strains on fore-and-aft stays and on mast shrouds due to the masts' height and weight. The metal plates to which the deadeyes of shrouds and stays are attached are chain plates.

Inspections of sunken boats to resolve fault or liability for an accident are sometimes required. The diver should check all sea cocks to determine if they are open or closed. Inspect all through-the-hull fittings and check internal fittings for tightness or loss. Inspect all hoses normally attached to through-the-hull fittings. Determine the condition of hose clamps and their positions on hoses. Hose clamps can corrode and loosen but they can also be removed to permit hose removal. The hull should be checked carefully for indications of fire or explosion. If there is fire damage try to determine source and cause. Check for empty containers that may have held flammables. In case of explosion, check to see if it was internal or external. Recover any and all items, large or small, that might help topside personnel analyze underwater conditions, causes and effects.

Divers or dive shops engaged in commercial diving should develop a short, descriptive brochure providing a resume of capabilites, equipment available, and any specialties that might make their services preferable to all other competitors. Make business calls on all organizations that might find use for the services of an underwater specialist. Marinas, boat yards, drydocks or marine railways, police, fire departments and insurance companies are several organizations that sometimes need the services of divers. A listing of your company name, and services provided, in the classified telephone directory may lead to a job.

Next month Technifacts will discuss and answer questions relating to small boat maintenance and repair for the diver. In the following month information on boat salvage will be presented.

SEA DWELLERS MOVE

Sea Dwellers Dive Center, established in 1973, has moved to a more convenient highway location. Sea Dwellers is now at the corner of U.S. 1, Mile Marker 100 and Ocean Dr., at Oceanside Marina, one block north of the Holiday Inn, Key Largo, Florida.

For more information contact Sea Dwellers Dive Center, P.O. Box 1796, Key Largo, FL 33037, or phone (305) 451-3640; (305) 245-0333 Miami line.

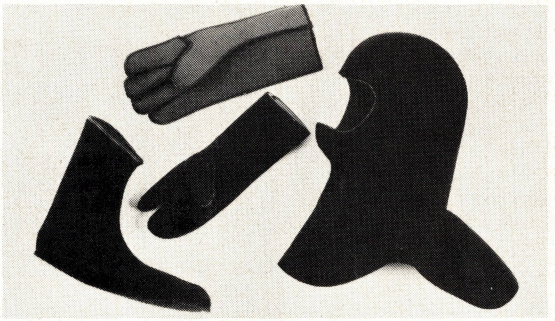
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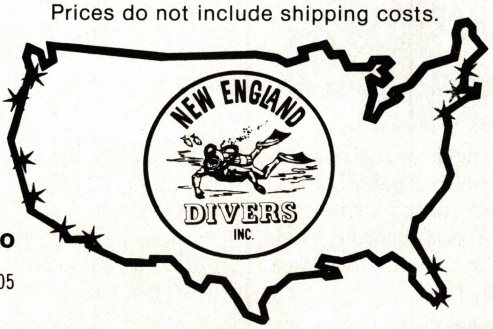
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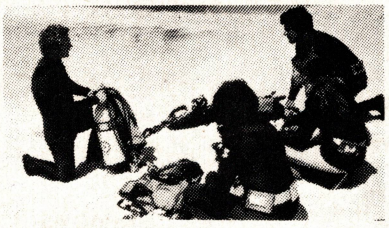
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TEXT AND PHOTOGRAPHY BY HOWARD B. TOWER, JR.

The St. Marys River is a natural boundary between Florida and Georgia beginning at the Okefenokee Swamp and terminating at the Atlantic Ocean. Spanish explorers named the river and established a mission on a bluff near its entrance in 1580. Thus began a series of settlements which evolved into the town of St. Marys, Georgia, a center of military activity during the Revolutionary War, War of 1812



and the Civil War. Today's residents refer to their community as America's second oldest city.

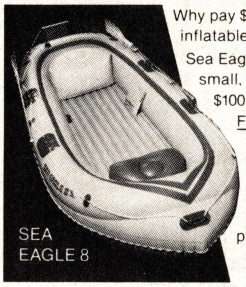
As serious artifact divers, my companions and I had recovered hundreds of antique bottles, clay smoking pipes, china and nautical items from towns and plantation sites located along the upper reaches of the St. Marys River. Our success was largely owing to the river's lime rock channel bottom. We always assumed the coastal portion of the river channel was soft, shifting sand; therefore St. Marys was not considered a potential dive site.

While doing historical research at the Jacksonville, Florida Public Library one day, I found an old nautical chart of the St. Marys River entrance dated 1850. The river channel was shown in great detail, with numerous soundings and contours. The chart indicated the river bottom was hard sand. I obtained a modern chart of the same area; a comparison indicated the channel at the town had not changed in over a century. I discussed this discovery with my dive companions and together we planned a dive.

St. Marys, Georgia is 40 miles north of my home in Jacksonville, Florida. Old homes amid giant live oak trees reflect the colonial south of two centuries ago. Commercial fishing vessels now dock at the town waterfront. Dock owners gave us permission to dive from their property. A number of people gathered

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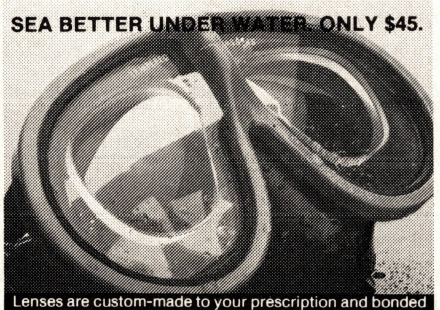
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to watch us prepare for our dive; they had never seen scuba divers and were anxious to see what we would recover from the black, murky saltwater. It was a sunny January day.

The four of us donned our gear and waded across a mud flat to the water's edge where we sat down in the goo to put on our fins. Casting our floats on the water we then submerged. The bottom dropped quickly to 30 feet; it was hard packed sand and gravel. I took a minute to allow my eyes to adjust to the visibility — three feet, with a light! The metallic sounds of my companion's regulators indicated their presence in the darkness. I began to search using a loose zig-zag sweep. Everything was covered with barnacles; an occasional blue crab scurried in and out of my light beam. Minutes later, a half-buried object caught my eye; when I took a close look at it, I realized it was a small clay Spanish wine bottle. My research had paid off. Moments later I found a crude black glass bottle — vintage 1830. Numerous bases and necks of 18th century rum bottles were also visible. It was time to get surface references and confer with my buddies.

My friends' results paralleled mine; we pinpointed the original colonial waterfront — an area 200 feet wide, centered between two fish packing houses. Elated, we returned to Jacksonville knowing it would take many dives to completely cover this site. My Spanish wine bottle was examined by experts, and dated between 1580 and 1620.

We searched the waterfront almost weekly for the next five months. Hundreds of antique bottles manufactured



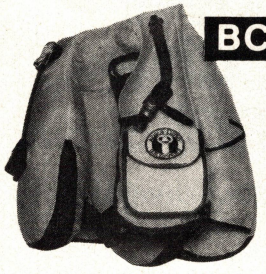
between 1760 and 1910 were found. Pottery items two centuries old were found; the fingerprints of their makers preserved on them by the salt glaze. Objects reflecting every period of the area's history were recovered and our diving attracted the interest of the entire town.

St. Marys, Georgia was the first experience we had diving in murky salt water along the Georgia-Florida coast. Many valuable lessons were learned which should be of interest to other divers. The safest time to dive sites under these conditions is between No-

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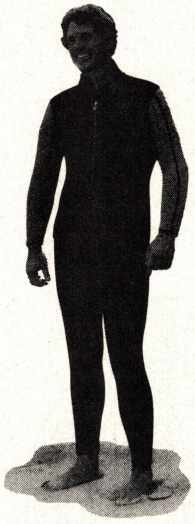
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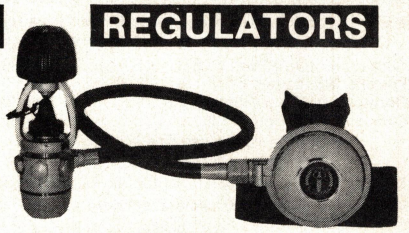
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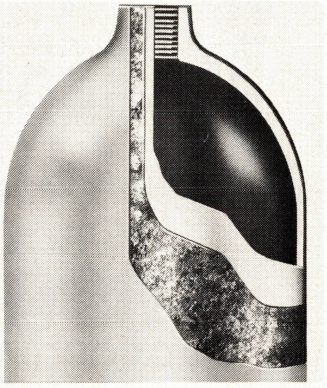
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BY TEDD DAVISON

I obtained a steel scuba tank from a friend. When I inspected the tank's interior, I found rust on the sides of the tank as well as on the bottom. The tank had a white epoxy interior coating. I took the tank to my dive shop pro, Bill Tyger, of B & B Marine, Hillsville, PA and he confirmed my observation that the tank could not be successfully tumbled to remove the rust because of the interior coating.

I work for an industrial plating company, and so have at my disposal several cold solvent paint strippers. These are used to remove paint from parts prior to electroplating. Bill and I decided to try to remove the epoxy coating with



Ultrastrip 252, a cold solvent paint stripper ordered from Fredrick Gumm Chemical Co., P.O. Box 497, Kearny, NJ.

We began the cleaning process by loading the tank with three quarts of Ultrastrip 252, and 20 pounds of 3/16 inch ceramic tumbling media. We then tumbled the tank for eight hours. This tumbling completely removed all of the interior epoxy coating. Further inspection revealed more rust that had been hidden under the epoxy coating.

We emptied the tank of the Ultrastrip, leaving the ceramic media in the tank. Fresh water was added and the tank tumbled for three more hours. Then, we removed the water from the tank, added

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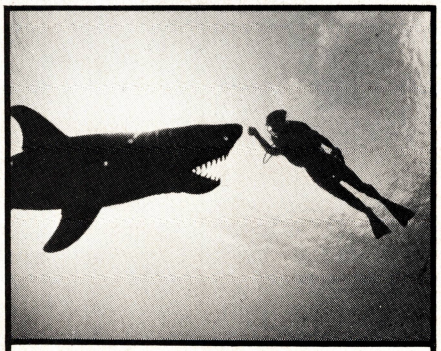
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detergent, more fresh water, and tumbled for another three hours.

After this tumbling, the detergent water and ceramic media were removed from the tank, and a solution of one cup baking soda, with fresh water added, was tumbled inside the tank for an additional 30 minutes.

Then we discarded the baking soda solution and rinsed the tank with fresh water. The tank was sent for hydrostatic testing. After successfully passing the hydrostat the tank was tumbled with steel chips, then blown out with compressed air; the valve replaced, and filled with air.

I am pleased that our efforts have provided me with a safe, second scuba tank at very little cost. In summary, the procedure used is as follows:

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3) Tumble three hours with fresh water and detergent.
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5) Hydrostatic test.
6) Tumble with steel chips, blow-out, replace valve, and fill with air.

This information should be of some benefit to the many scuba divers who thought that a rusted interior coated tank could never be used again.

BOTTLE BONANZA

vember and April. During the warmer months many varieties of sea life return to coastal areas to mate or lay eggs. They are followed by predators including sharks. Large sea turtles are attracted to divers' lights and on two occasions attacked divers. Fortunately there were no serious injuries. Dead fish thrown into the water from the packing houses and shrimpers also promoted aggressive behavior of sea turtles and large fish. For safety, always hold the float line spool or stick in your hand so it can be released instantly. A careless boater or shrimper can snag a float line in his propeller shaft thus pulling an unfortunate diver into a set of whirling blades. Diving at St. Marys, Georgia should only be attempted by experienced divers. Basic equipment required is a full wetsuit (for body protection), a dependable light, buoyancy compensator, knife, submersible pressure gauge, weightbelt, depth gauge and the all important goodie bag. Since visual contact with other divers is impossible, a set of signals, such as three bangs on a tank, must be arranged to indicate distress or a major find.

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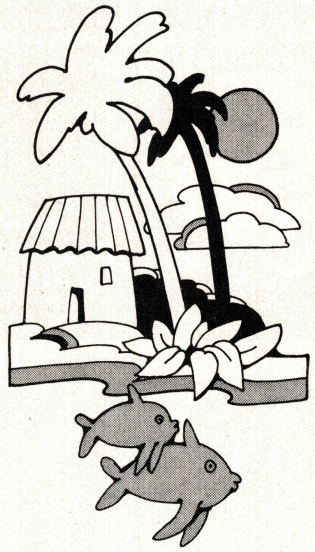
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CONTROL Seachute, the total control B.C. Inflate with the power inflator, deflate with a touch of the finger for your ideal buoyancy at any depth. You've got wrap around support with air chambers front and back for balanced trim throughout your dive. You decide where you want to be, the Seachute helps you stay there saving you effort and valuable air time.

CONFIDENCE You have the confidence that the quality is built in at Dacor. Our R& D and engineering department have made this top-of-the-line B.C. with the features you, the diver, wanted: VIS power inflator (standard), NQP cam-lock backpack (standard), over pressure relief valve, rugged nylon shell, inflate/deflate hose, removable urethane bladder, mesh drain on two front and two back panels, two 10″ x 6″ pockets with Velcro closures, 25 gram CO^2 cartridge and detonator. Available in orange with black trim and blue with silver trim, medium and large sizes. For a complete demonstration, see your Dacor Dealer.

DACOR

DACOR CORPORATION ▪ 161 Northfield Road ▪ Northfield, Illinois 60093 ▪ P.O. Box 157

Send $2.00 for Dacor Divers Kit. Includes catalog, cloth patch, decomp. table, decals.

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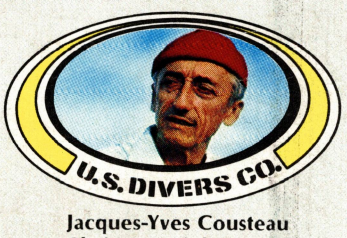


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